# Appendix A

## Monitored Data

This appendix presents the 8-hour ozone 4th high values from monitored ozone data and calculations for all sites in the Portland Nonattainment Area

All data and calculations meet the criteria for data handling contained in EPA's December 1998 "Guideline on Data Handling Conventions for the 8-Hour Ozone NAAQS " For this analysis, the most significant of these data handling conventions are·

- A valid ozone monitoring day consists of 'at least 18 out of 24 possible 8-hour averaging periods' unless 'the daily maximum 8-hour average concentration for the day is greater than 0 08 ppm '
- 'A valid year must have valid 8-hour daily maximum ozone concentrations for at least 75% of the required monitoring days in the ozone season' unless the 4th high value is greater than 0 08 ppm
- For purposes of determining attainment status, 'all three years must average at least 90% data completeness.' In the event that the 3-year average of the 4th high values exceeds 0.08 ppm then years with less than 75% data recovery are included in the calculations.

Design values are calculated by taking the average of 3 consecutive years' 4th high values (which meet the data handling conventions sited above). The year cited for the design value is the final year of the 3-year average.

Table A-1 contains data for the current Portland Nonattainment Area since 1981 The data includes the 4th high value for each year, the valid design value and recovery rates both for individual years and 2006 threshold values.

Threshold values are the 4th high value needed in 2006 to cause the design value calculation to exceed the ozone NAAQS . Threshold values help to determine the likelihood of a given site/area meeting (or exceeding) the ozone NAAQS in the following ozone season. Table A-1 clearly demonstrates that the Portland Nonattainment Area's monitored 4th high values have not exceeded the current thresholds for 2006 since 1991 (4th high values that exceed the threshold are colored orange). Therefore, the likelihood that the current Portland Nonattainment Area would maintain a redesignated attainment status is great

Table A-1: 4[th] high values, design values, recovery rates and threshold analysis for each site in the Portland nonattainment area.

| MONITOR | 8-HR OZONE PARAMETER | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| YORK COUNTY | | | | | | | | | | | | | | | | |
| Kittery 23-031-3002 | VALID 4TH HIGH | | | | | | | | | | | | | | | |
| Kittery 23-031-3002 | SEASON RECOVERY RATE | | | | | | | | | | | | | | | 82% |
| Kittery 23-031-3002 | VALID DESIGN VALUE | | | | | | | | | | | | | | | *** |
| Kittery 23-031-3002 | 3-YR RECOVERY RATE | | | | | | | | | | | | | | | --- |
| Kennebunkport 23-031-2002 | VALID 4TH HIGH | | | | | [redacted] | 98 | [redacted] | [redacted] | [redacted] | 106 | [redacted] | 100 | 95 | 91 | 103 |
| Kennebunkport 23-031-2002 | SEASON RECOVERY RATE | | | 73% | 74% | 88% | 91% | 95% | 88% | 86% | 91% | 97% | 100% | 91% | 90% | 99% |
| Kennebunkport 23-031-2002 | VALID DESIGN VALUE | | | *** | *** | 116 | 112 | 112 | 112 | 117 | 115 | 109 | 105 | 102 | 95 | 96 |
| Kennebunkport 23-031-2002 | 3-YR RECOVERY RATE | | | --- | *** | 79% | 84% | 91% | 91% | 88% | 88% | 91% | 96% | 96% | 94% | 94% |
| Hollis 23-031-0037 | VALID 4TH HIGH | | | | | | | | | | | | | | | |
| Hollis 23-031-0037 | SEASON RECOVERY RATE | | | | | | | | | | | | | | | |
| Hollis 23-031-0037 | VALID DESIGN VALUE | | | | | | | | | | | | | | | |
| Hollis 23-031-0037 | 3-YR RECOVERY RATE | | | | | | | | | | | | | | | |
| West Buxton 23-031-0038 | VALID 4TH HIGH | | | | | | | | | | | | | | | |
| West Buxton 23-031-0038 | SEASON RECOVERY RATE | | | | | | | | | | | | | | | |
| West Buxton 23-031-0038 | VALID DESIGN VALUE | | | | | | | | | | | | | | | |
| West Buxton 23-031-0038 | 3-YR RECOVERY RATE | | | | | | | | | | | | | | | |
| CUMBERLAND COUNTY | | | | | | | | | | | | | | | | |
| Cape Elizabeth 23-005-2003 | VALID 4TH HIGH | 101 | 105 | [redacted] | 108 | [redacted] | 99 | [redacted] | [redacted] | 101 | 92 | 109 | 97 | 89 | 88 | 96 |
| Cape Elizabeth 23-005-2003 | SEASON RECOVERY RATE | 89% | 94% | 98% | 91% | 87% | 96% | 98% | 96% | 92% | 92% | 97% | 97% | 96% | 98% | 99% |
| Cape Elizabeth 23-005-2003 | VALID DESIGN VALUE | *** | *** | 107 | 110 | 116 | 110 | 112 | 112 | 113 | 105 | 100 | 99 | 98 | 91 | 91 |
| Cape Elizabeth 23-005-2003 | 3-YR RECOVERY RATE | --- | --- | 94% | 94% | 92% | 91% | 94% | 97% | 95% | 93% | 94% | 95% | 97% | 97% | 98% |
| SAGADAHOC COUNTY | | | | | | | | | | | | | | | | |
| Phippsburg 23-023-0003 | VALID 4TH HIGH | | | | | | | | | | | | | | 80 | 89 |
| Phippsburg 23-023-0003 | SEASON RECOVERY RATE | | | | | | | | | | | | | 59% | 96% | 90% |
| Phippsburg 23-023-0003 | VALID DESIGN VALUE | | | | | | | | | | | | | *** | --- | 92 |
| Phippsburg 23-023-0003 | 3-YR RECOVERY RATE | | | | | | | | | | | | | --- | *** | 82% |
| Reid State Park 23-023-0004 | VALID 4TH HIGH | | | | | | | | | | | | | | | |
| Reid State Park 23-023-0004 | SEASON RECOVERY RATE | | | | | | | | | | | | | | | |
| Reid State Park 23-023-0004 | VALID DESIGN VALUE | | | | | | | | | | | | | | | |
| Reid State Park 23-023-0004 | 3-YR RECOVERY RATE | | | | | | | | | | | | | | | |
| PORTLAND NONATTAINMENT AREA | 4TH HIGH MAX | 101 | 105 | 117 | 108 | 126 | 99 | 116 | 127 | 112 | 106 | 111 | 100 | 95 | 91 | 103 |
| PORTLAND NONATTAINMENT AREA | DESIGN VALUE MAX | | | 107 | 110 | 116 | 112 | 112 | 112 | 117 | 115 | 109 | 105 | 102 | 95 | 96 |

Table A-1 continued 4th high values, design values, recovery rates and threshold analysis for each site in the Portland nonattainment area.

| MONITOR | 8-HR OZONE PARAMETER | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | ACTIVE Monitors 2006 THRESHOLD | Historical exceedi… of the 2006 Thre… |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| YORK COUNTY | | | | | | | | | | | | | |
| Kittery 23-031-3002 | VALID 4TH HIGH | 79 | 92 | 89 | 85 | 70 | 90 | 94 | 80 | 80 | 72 | 103 | |
| Kittery 23-031-3002 | SEASON RECOVERY RATE | 96% | 99% | 99% | 96% | 93% | 97% | 96% | 99% | 95% | 86% | | |
| Kittery 23-031-3002 | VALID DESIGN VALUE | *** | 86 | 86 | 88 | 81 | 81 | 84 | 88 | 84 | 77 | | |
| Kittery 23-031-3002 | 3-YR RECOVERY RATE | *** | 86% | 98% | 96% | 96% | 95% | 96% | 98% | 97% | 97% | | |
| Kennebunkport 23-031-2002 | VALID 4TH HIGH | 84 | 101 | 86 | 89 | 73 | 96 | 101 | 78 | 76 | 71 | 108 | |
| Kennebunkport 23-031-2002 | SEASON RECOVERY RATE | 94% | 98% | 96% | 96% | 97% | 94% | 88% | 99% | 96% | 79% | | |
| Kennebunkport 23-031-2002 | VALID DESIGN VALUE | 92 | 96 | 90 | 92 | 82 | 86 | 90 | 91 | 84 | 74 | | |
| Kennebunkport 23-031-2002 | 3-YR RECOVERY RATE | 95% | 97% | 96% | 96% | 97% | 97% | 96% | 97% | 96% | 92% | | |
| Hollis 23-031-0037 | VALID 4TH HIGH | | 77 | 72 | | | | | | | | | |
| Hollis 23-031-0037 | SEASON RECOVERY RATE | | 94% | 99% | | | | | | | | | |
| Hollis 23-031-0037 | VALID DESIGN VALUE | | *** | *** | | | | | | | | | |
| Hollis 23-031-0037 | 3-YR RECOVERY RATE | | 31% | 64% | | | | | | | | | |
| West Buxton 23-031-0038 | VALID 4TH HIGH | | | | 80 | 66 | | 83 | 69 | 75 | 76 | 104 | |
| West Buxton 23-031-0038 | SEASON RECOVERY RATE | | | | 100% | 97% | 67% | 100% | 100% | 100% | 98% | | |
| West Buxton 23-031-0038 | VALID DESIGN VALUE | | | | *** | *** | *** | *** | *** | 75 | 73 | | |
| West Buxton 23-031-0038 | 3-YR RECOVERY RATE | | | | *** | *** | 88% | 88% | 89% | 100% | 99% | | |
| CUMBERLAND COUNTY | | | | | | | | | | | | | |
| Cape Elizabeth 23-005-2003 | VALID 4TH HIGH | 83 | 103 | 89 | 76 | 67 | 97 | 96 | 73 | 68 | 73 | 114 | |
| Cape Elizabeth 23-005-2003 | SEASON RECOVERY RATE | 99% | 98% | 99% | 98% | 99% | 98% | 99% | 100% | 97% | 99% | | |
| Cape Elizabeth 23-005-2003 | VALID DESIGN VALUE | 88 | 94 | 91 | 89 | 77 | 80 | 86 | 88 | 79 | 71 | | |
| Cape Elizabeth 23-005-2003 | 3-YR RECOVERY RATE | 99% | 99% | 99% | 98% | 98% | 98% | 99% | 99% | 99% | 99% | | |
| SAGADAHOC COUNTY | | | | | | | | | | | | | |
| Phippsburg 23-023-0003 | VALID 4TH HIGH | 89 | 98 | 91 | 87 | 75 | | | | | | | |
| Phippsburg 23-023-0003 | SEASON RECOVERY RATE | 98% | 92% | 97% | 93% | 99% | | | | | | | |
| Phippsburg 23-023-0003 | VALID DESIGN VALUE | 92 | 95 | 92 | 92 | 84 | | | | | | | |
| Phippsburg 23-023-0003 | 3-YR RECOVERY RATE | 95% | 93% | 95% | 94% | 97% | | | | | | | |
| Reid State Park 23-023-0004 | VALID 4TH HIGH | | | | | | | 98 | 74 | 69 | 68 | 118 | |
| Reid State Park 23-023-0004 | SEASON RECOVERY RATE | | | | | | | 90% | 90% | 100% | 83% | | |
| Reid State Park 23-023-0004 | VALID DESIGN VALUE | | | | | | | *** | *** | 79 | 70 | | |
| Reid State Park 23-023-0004 | 3-YR RECOVERY RATE | | | | | | | *** | *** | 93% | 91% | | |
| PORTLAND NONATTAINMENT AREA | 4TH HIGH MAX | 89 | 103 | 91 | 89 | 75 | 97 | 101 | 80 | 80 | 76 | | |
| PORTLAND NONATTAINMENT AREA | DESIGN VALUE MAX | 92 | 96 | 92 | 92 | 84 | 86 | 90 | 91 | 84 | 77 | | |

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# Appendix B

## Chemical Analysis

Photochemical assessment monitoring station (PAMS) sites monitor chemicals associated with ozone formation, ozone and meteorological data. The data from sites in Maine and Massachusetts has been analyzed by MEDEP staff meteorologists. Massachusetts sites were included because they are upwind of Maine. The meteorological portion of the analysis is presented in Appendix C.

**BACKGROUND INFORMATION:**

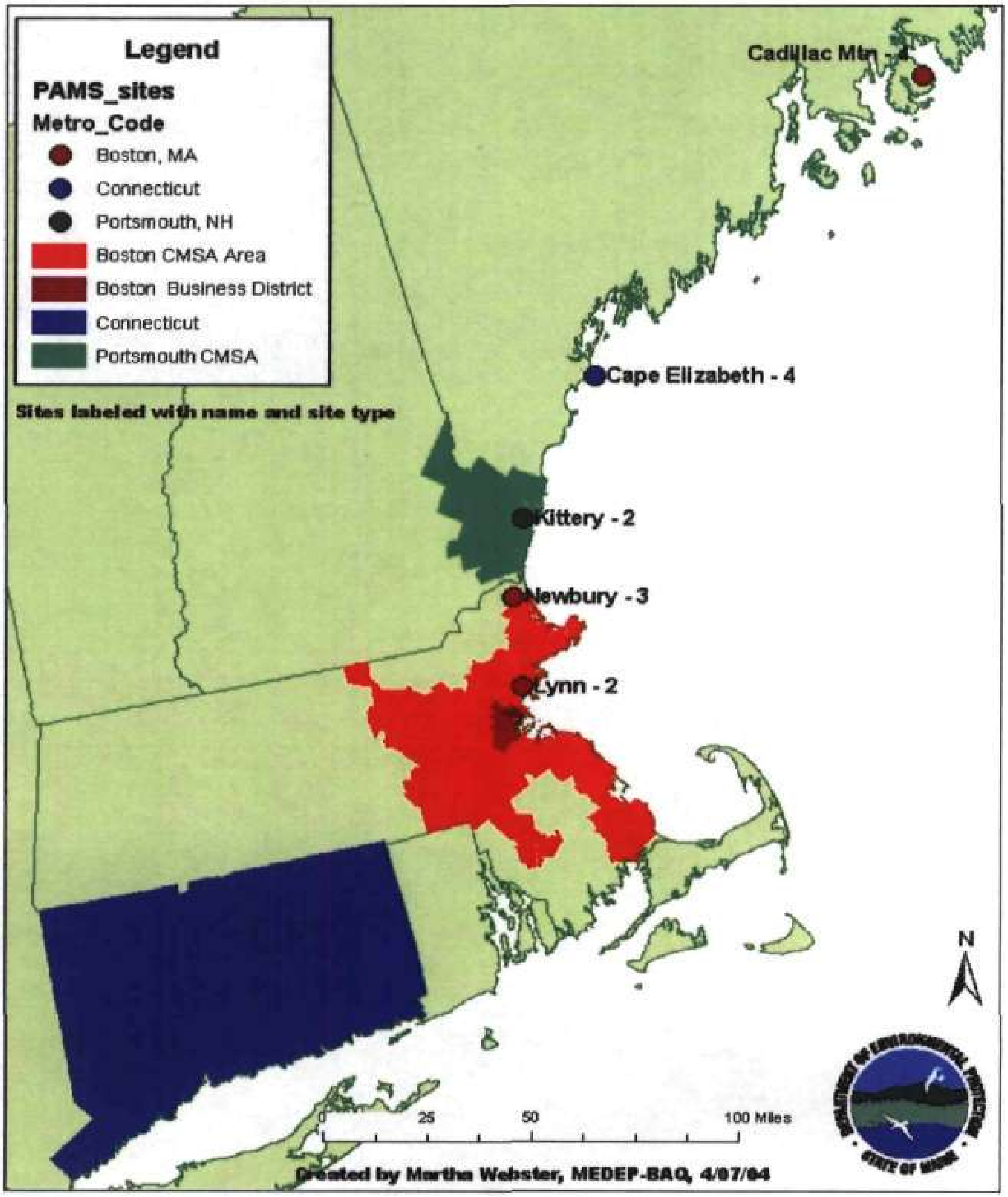
The Clean Air Act Amendments of 1990 required EPA to promulgate regulations for the "enhanced" monitoring of ozone and its precursors for ozone nonattainment areas classified as serious, severe or extreme Both Congress and EPA recognized the need for an improved understanding of the ozone problem, and better feedback mechanisms for evaluating the effectiveness of ozone control strategies. In 1993, EPA published the final rule detailing the minimum requirements for PAMS, which includes measurements of nitrogen oxides (NOx), speciated volatile organic compounds (VOCs), and meteorological parameters. These monitoring regulations provide for the collection of an "enhanced" ambient air quality database which can be used to better characterize the nature and extent of the ozone problem, aid in tracking VOC and NOx emission inventory reductions, assess air quality trends, make attainment/nonattainment decisions, and evaluate photochemical grid-model performance.

There are four different types of PAMS sites, each serving a specific monitoring purpose. a Type 1 is upwind of the urban area and represents background concentrations coming into the area, a Type 2 is on the downwind fringe of the urban area and represents maximum precursor concentrations from the area; a Type 3 is located in an area with maximum ozone concentrations; and a Type 4 is at extreme downwind location to represent long-range transport from the area. Therefore, PAMS sites required for an area will not necessarily all be located within the boundaries of the non-attainment area. Thus Maine, with no serious, severe or extreme non-attainment areas itself, has three PAMS sites in operation.

Figure B-1 displays the sites included within the analysis. The number following each site name indicates the type of site it is while the color of the circle indicates the area it is related to. There are no Type 1 sites included within the analysis.

The distinguishing features that make PAMS sites truly "enhanced" ozone monitoring stations is that they collect meteorological, ozone and its precursors (oxides of nitrogen and VOCs) data simultaneously. Gaining a better understanding of how these variables interact with each other in actual real-world instances is necessary in order to effectively address Maine's and the nation's continuing ozone problem.

Figure B-1




## ANALYSIS DESCRIPTION:

There are five sites within the geographical region of study; Kittery, Cape Elizabeth, Cadillac Mountain, Newbury and Lynn are in Massachusetts. The sites are listed below along with the years of data used in the analysis and the state agency responsible for maintaining the site.

- Top of CADILLAC MOUNTAIN, Maine
  - 1995-2004 data downloaded from AQS

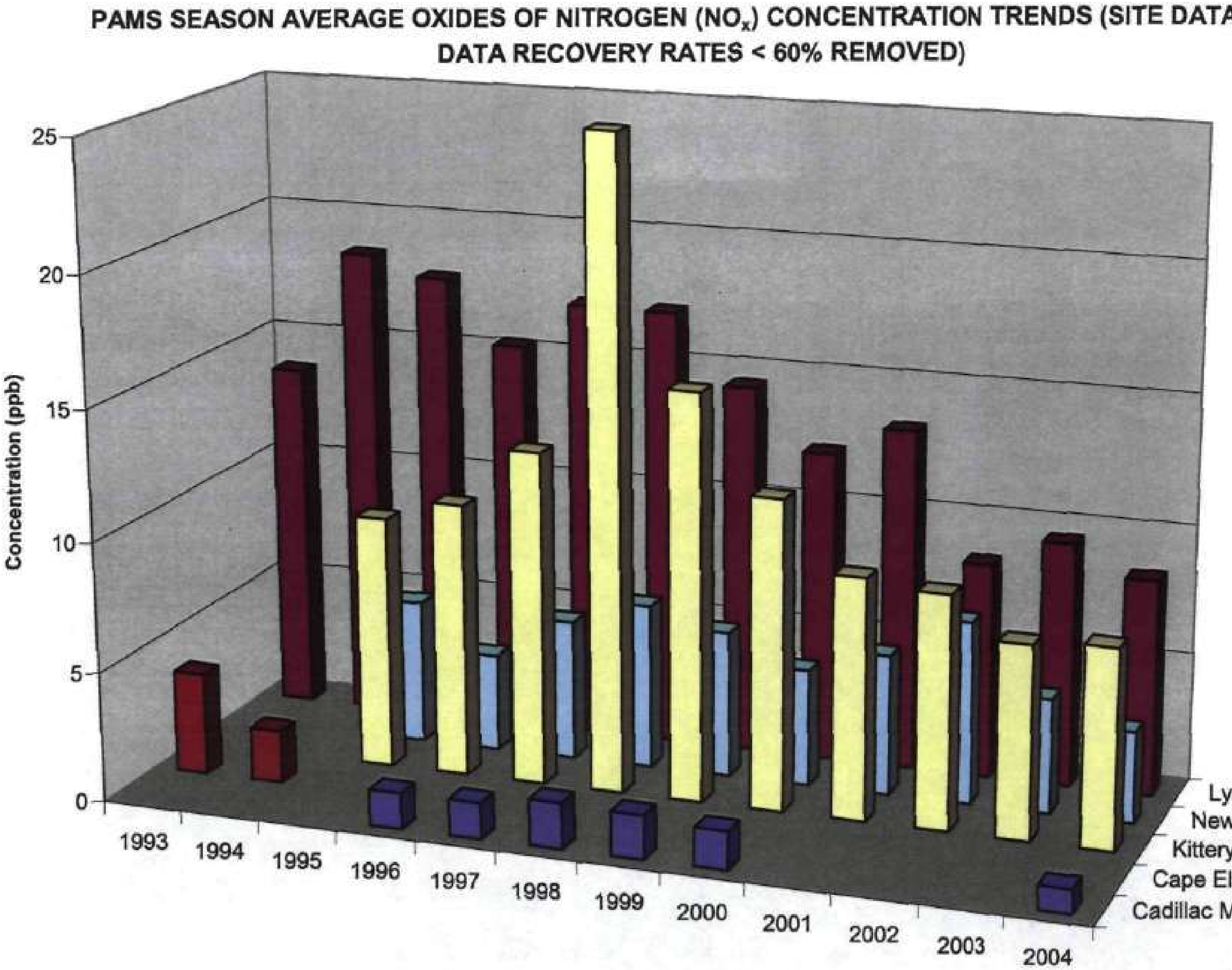
- site operator - MEDEP
- CAPE ELIZABETH, Maine
  - 1993-2004 data downloaded from AQS
  - site operator - MEDEP
- KITTERY, Maine
  - 1995-2003 data downloaded from AQS
  - site operator - NHDES
  - some data from this site is questionable and therefore not included in every aspect of the analysis
- NEWBURY, Massachusetts
  - 1994-2003 data downloaded from AQS
  - site operator - MADEP
- LYNN, Massachusetts
  - 1993-2003 data downloaded from AQS
  - site operator - MADEP

Analysis of the wealth of data is extensive and ongoing. Only the most pertinent graphs are included herein Listed below is a sampling of the extent of the analysis

- PAMS Season (June 1 to August 31) Data Summary Statistics for all 5 sites
  - averages and maximums for all compounds
  - data recovery rates
  - % of data below minimum detect levels (MDL)
  - 50th , 70th and 90th Percentiles
- Plots
  - 1993-2004 event averaged plots for all compounds (5-sites plotted)
  - 1997-2003 and 1997-2002 event averaged plots for all compounds (5-sites plotted)
  - Multi-year PAMS season hourly plots for all compounds (1-site plotted)
  - Ozone pollution roses averaged for all 1993-2004 PAMS season hours > 64ppb, >81ppb
- MAP
  - Elevated 1-hr avg Ozone concentration (>64ppb and >81ppb) wind direction frequencies (all data @ 5 sites) (found in Appendix C)

The compounds of greatest pertinence to ozone are oxides of nitrogen (NOx), PAMS target compounds (PAMHC) and total non-methane organic carbons (TNMOC). The trends of these focus compounds are displayed in Figures B-2 through B-4. For the Portland Nonattainment Area and sites upwind these compounds are all trending downward so the area is not likely to exceed the ozone NAAQS in the future.

## Figure B-2



PAMS SEASON AVERAGE OXIDES OF NITROGEN ($NO_x$) CONCENTRATION TRENDS (SITE DATA
DATA RECOVERY RATES < 60% REMOVED)
Concentration (ppb)
25
20
15
10
5
0
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
Ly
New
Kittery
Cape El
Cadillac M

**Figure B-3**

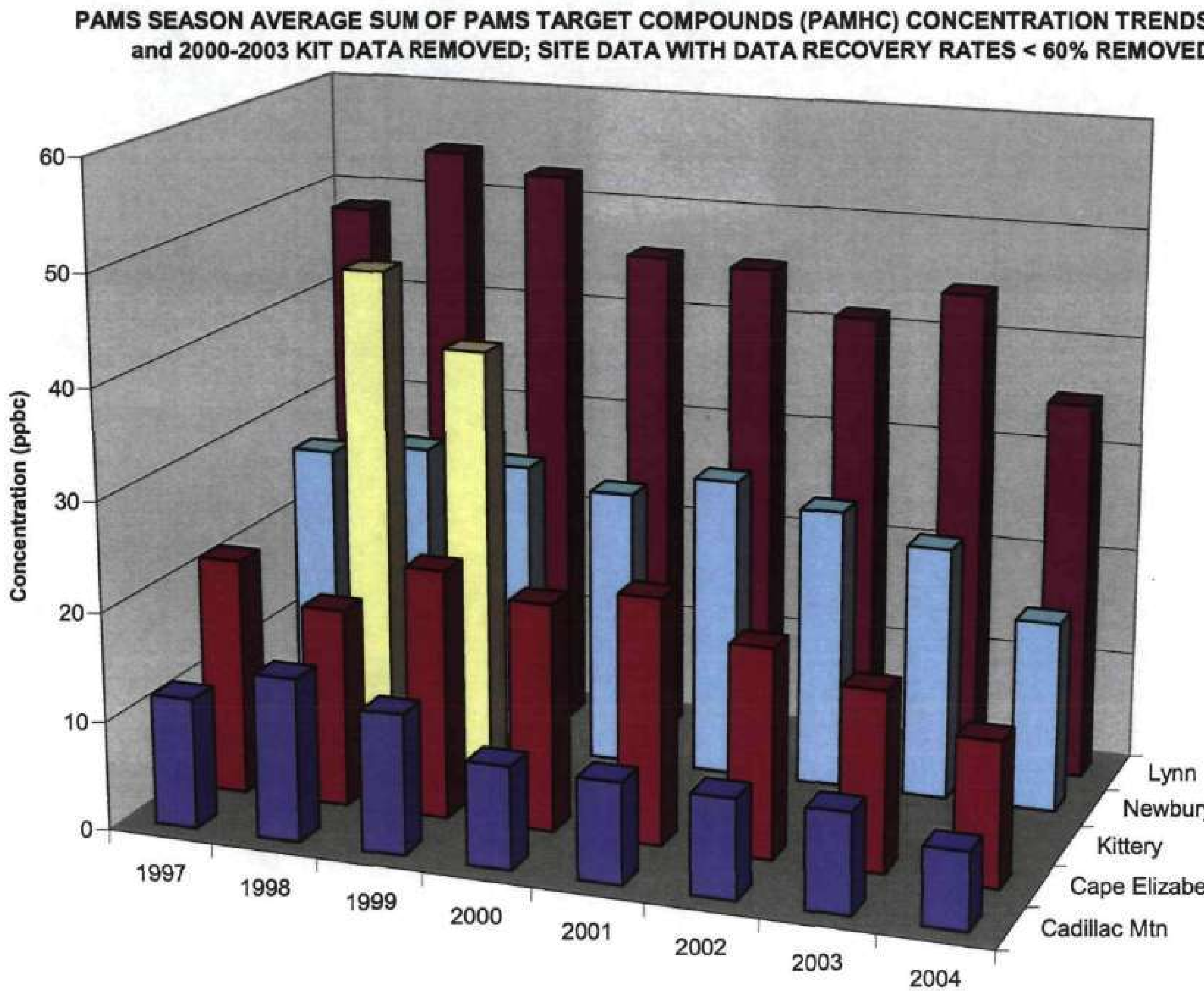
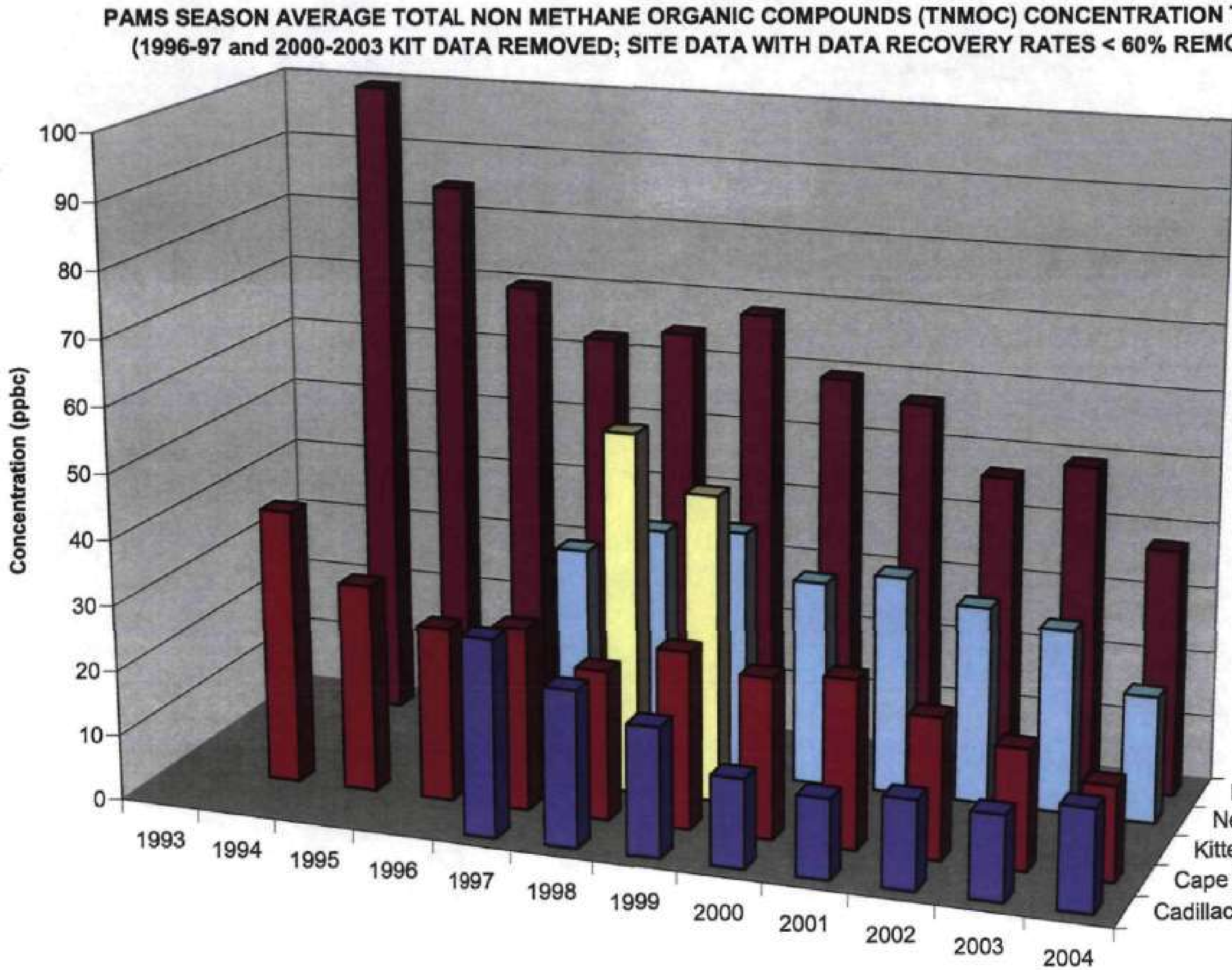

PAMS SEASON AVERAGE SUM OF PAMS TARGET COMPOUNDS (PAMHC) CONCENTRATION TRENDS
and 2000-2003 KIT DATA REMOVED; SITE DATA WITH DATA RECOVERY RATES < 60% REMOVED
Concentration (ppbc)
60
50
40
30
20
10
0
1997
1998
1999
2000
2001
2002
2003
2004
Lynn
Newbur
Kittery
Cape Elizabe
Cadillac Mtn

**Figure B-4**


PAMS SEASON AVERAGE TOTAL NON METHANE ORGANIC COMPOUNDS (TNMOC) CONCENTRATION
(1996-97 and 2000-2003 KIT DATA REMOVED; SITE DATA WITH DATA RECOVERY RATES < 60% REM
Concentration (ppbc)
100
90
80
70
60
50
40
30
20
10
0
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
Kitt
Cape
Cadillac

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# Appendix C

## Meteorological Data Analyses

## Executive Summary of the Meteorological Analyses

Meteorology is a major factor in the formation and transport of ozone and its precursors. High ozone concentrations in southern Maine occur most often when low pressure systems approach from the Great Lakes or southern Canada while high pressure is situated just off the eastern seaboard. When such a scenario is in place, it provides warm temperatures, clear skies, and southwesterly winds to allow the transport of precursors into the Northeast

These meteorological data analyses illustrate that exceedance days in Maine occur when the surface wind has a southwesterly component along with a westerly wind component at the 850 mb level These directions indicate that ozone and its precursors are transported from larger metropolitan areas into York, Cumberland, and Sagadahoc counties on exceedance days These conclusions have been well-known and documented for years.

Historically, ozone levels have exceeded the standard even during marginally favorable transport conditions. . As ozone precursors are reduced, through a variety of point, area and mobile source controls, wind direction becomes a more critical factor for ozone buildup in Maine. Thus, Maine now requires a 'direct hit' of ozone and precursors from large urban areas to cause ozone exceedances.

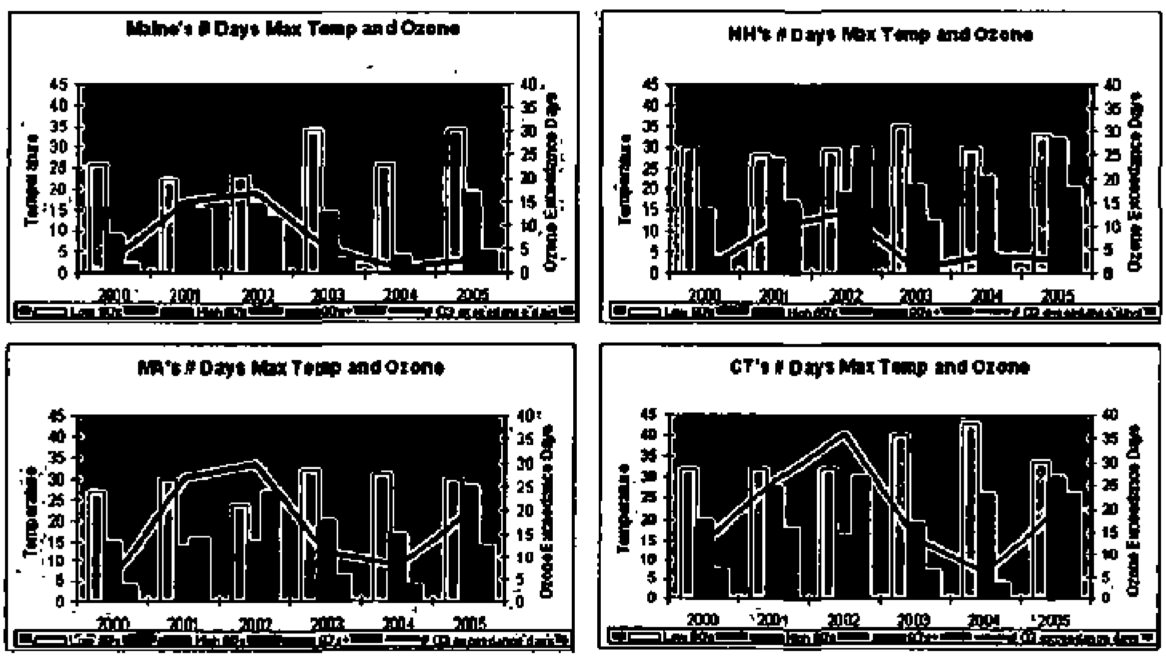
In the event that meteorological conditions during future summers again favor transport to Maine, ozone levels in the Portland Nonattainment Area are less likely to exceed the standard due to the fact that the NOx SIP call and other emission control programs have reduced emissions of NOx and VOC in the region.

Even though temperatures during the peak of the 2005 Ozone season were above normal, ozone levels in Maine were similar to the cooler summers of 1996, 2000, 2003 and 2004 This was a result of reduced ozone and precursors available to be transported to Maine along with less favorable transport conditions. There has been a clear decline in the number of ozone exceedances in Maine over the last 17 years Thus, monitored attainment of the Portland Nonattainment Area is not primarily due to unusual meteorological conditions

## Regional Temperature Versus Ozone Graphs

Since ozone exceedances are typically associated with hot sunny summer days, Maine Department of Environmental Protection's Bureau of Air Quality (MEDEP-BAQ) staff meteorologists thought it might be useful to look at graphs of temperature versus ozone in New England. Maximum daily temperature data for Hartford, Connecticut; Worcester and Boston, Massachusetts; Manchester, New Hampshire, as well as Augusta and Bangor, Maine was downloaded from the National Weather Service's web site for the months of April through September for 2000 to 2005. With the exception of Boston, the cities chosen were major cities unaffected by sea breezes. Formulas were then written to count the number of days during each year's ozone season that the maximum daily temperature fell into a given range In Figure C-1, these counts are represented by the blue shaded bars. Next the number of ozone exceedances days that occurred within that state for each year is graphed using a red line The scale of these graphs is consistent for each state so that quick comparisons can be made

**Figure C-1 Temperature vs Ozone**




By viewing these charts together, the differences between northern and southern New England become apparent. The summer of 2005 was warmer than the two preceding summers across the region and there were an increased number of ozone exceedances recorded by every state. However, it is also apparent that the number of ozone exceedances was considerably fewer for the northern New England states both compared with the southern New England states and also with the previous high years of 2001 and 2002. Thus, hot sunny days are not the sole factor for ozone exceedances in northern New England or more specifically, Maine These charts also illustrate that even for southern New England the number of exceedances was lower than the high years of 2001 and 2002 even though the number of hot days was greater. The NOx SIP Call went into effect in 2003 and this may have contributed to the observed decrease in the number of ozone exceedances.

## Trajectory Analysis

A trajectory is a three dimensional representation of the path an air parcel followed based on forecast or archived meteorological data. A backward trajectory is the path the parcel took to reach a specific point in time and space, while a forward trajectory is the path the parcel followed upon leaving a specific time and place.

MEDEP-BAQ staff meteorologists conducted a trajectory analysis of ozone exceedances from the 2000 through 2005 ozone seasons. When an 8-hour ozone exceedance was recorded in the Portland Nonattainment Area, the analysis included every hour ozone levels were equal to or greater than 85 ppb. The time of the ozone value was converted from Eastern Standard Time (EST) to Universal Time Code (UTC) by adding 5 hours.

The National Oceanic and Atmospheric Administration (NOAA)'s Air Resources Laboratory HYSPLIT (HYbrid Single-Particle Lagrangian Integrated Trajectory) is a computer model used to create and map trajectories. The model uses gridded meteorological data. For more information about HYSPLIT please refer to the following document: "Description of the HYSPLIT 4 Modeling System by Draxler and Hess."

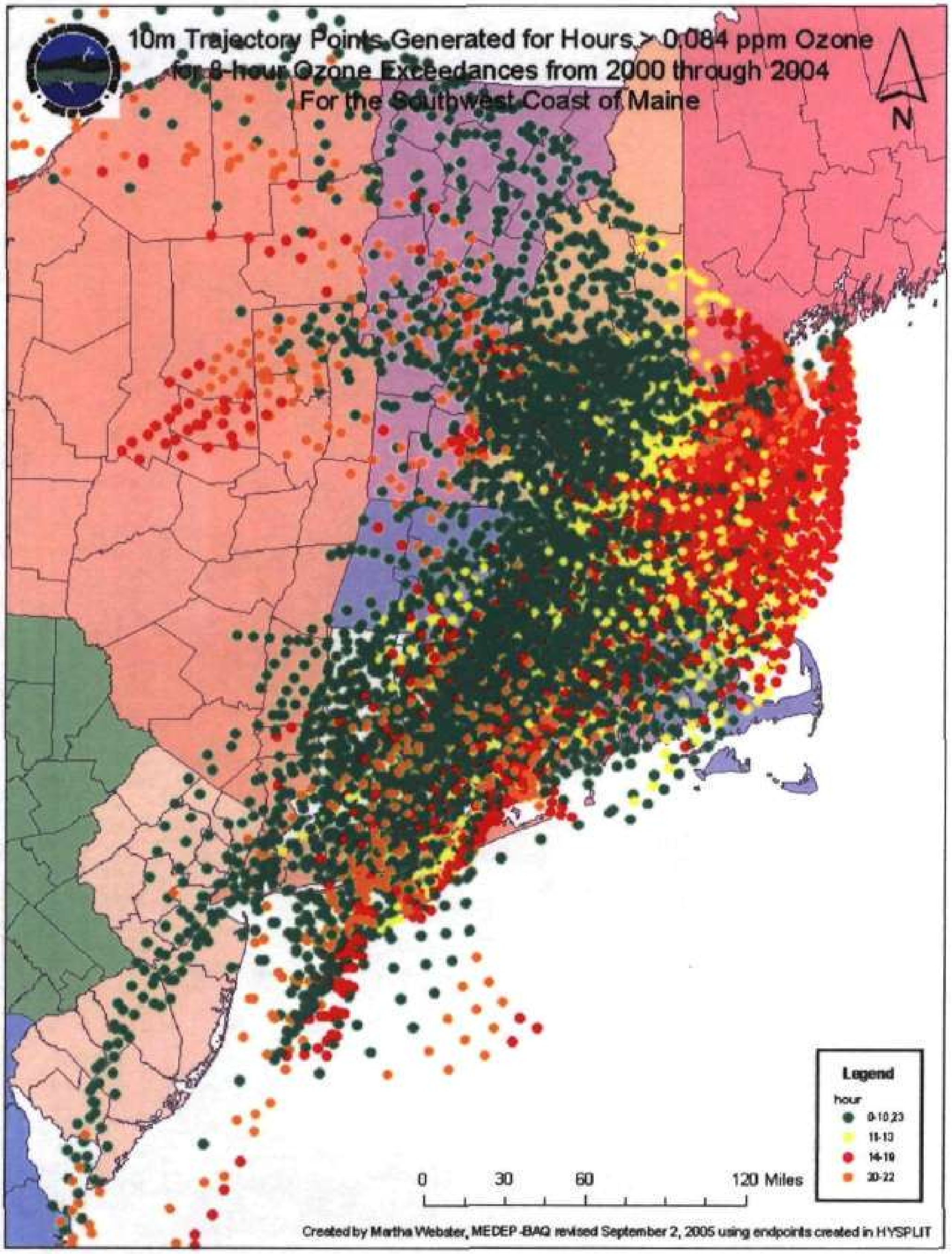
MEDEP-BAQ staff meteorologists used HYSPLIT to create the trajectories included in this analysis. The model was set to create 24-hour back trajectories from 10 meters (m) above ground level at each site and to include vertical velocity. The archived ETA Data Assimilation System (EDAS) meteorological (MET) data set was used for most trajectories because this was the most consistently available MET data set EDAS data at 80km spacing was available prior to 2004. The trajectories created for 2004 and 2005 events utilized the EDAS 40km MET files. There were several days when the EDAS MET file was missing data. When this occurred, the Global Final Analysis (FNL) MET data set was used.

For each run, the HYSPLIT model generates both a graphical presentation of the trajectories and a text file. The text file contains information about the hourly endpoints along each trajectory path including the location in time and space. Hundreds of endpoint text files were subsequently loaded into an Access database, which was then mapped in ARCMAP, a geographical mapping tool used within the MEDEP.

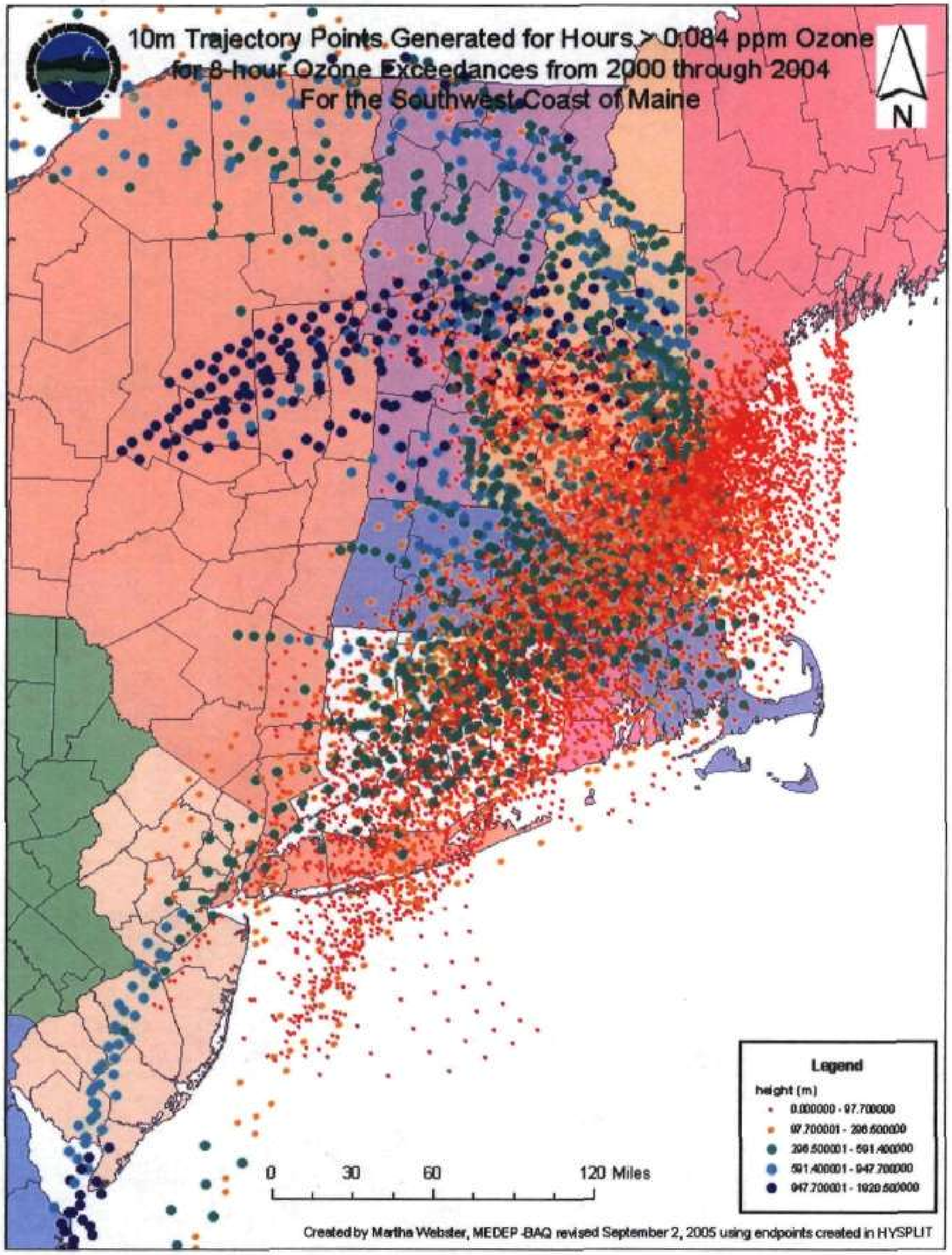
The maps visually display thousands of endpoints allowing the viewer to readily identify the transport patterns which result in high levels of ozone in Maine. Two maps have been created for the Portland Nonattainment Area. Figure C-2 displays the endpoints based on time of day red depicts the solar peak, green depicts night-time hours and orange and yellow are the transitions between the two. Figure C-3 displays the endpoints based on vertical height using both color and size to differentiate between the various heights.

Utilizing both means of displaying the endpoints resulted in a greater understanding of the transport patterns during high ozone events than would have been gained by either alone. Figure C-3 shows that southwest transport at the surface is the largest contributor to high concentrations of ozone. Frequently, transport from a more westerly direction is that of sinking air which is then caught in surface flow and transported to the monitors Other parcels traveled across neighboring states before reaching the Portland Nonattainment Area. Both figures illustrate that high concentrations of ozone are not caused by sources within the state of Maine. Thus, high ozone events are predominantly due to southwest surface winds bringing ozone and its precursors into Maine.

**Figure C-2 Trajectory by hour**



# Figure C-3 Trajectory by height



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## Streamline Analysis

MEDEP-BAQ staff meteorologists utilize many different tools to analyze ozone behavior in Maine Streamlines are one of these important tools Streamline graphics depict the wind field at a given time and place.

Most ozone analyses focus on ozone exceedances in Maine, however, it is equally important to study occasions when conditions were favorable for ozone production in New England, yet Maine did not record exceedances

A streamline analysis was performed for the 2000 through 2005 ozone seasons, when conditions that favor ozone production were present (high temperatures with bright sunshine) Therefore, the criteria for choosing which dates to analyze when Maine **DID NOT** record ozone exceedances were as follows:

- Days when either Augusta or Bangor, Maine recorded temperatures 85EF or higher, and/or
- Days when major cities in New England recorded temperatures of 90EF or higher, and/or
- Days when ozone exceedances occurred elsewhere in New England.

Using these criteria, 135 days were identified for the streamline analysis

The streamline graphics for New England were generated and downloaded from the National Oceanic and Atmospheric Administration's (NOAA) Real-time Environmental Applications and Display sYstem (READY) web site (http://www.arl.noaa.gov/ready/ametus.html) using archived meteorological files The most detailed meteorological data available for each date was used to generate the streamline graphics at 18z (2 PM EDT) for each day and both temperature and streamlines were displayed EDAS meteorological data was used for all but one date due to lack of data. [EDAS data was available at 80km spacing through 2003. Beginning with the 2004 season, EDAS data at 40km spacing became available ]

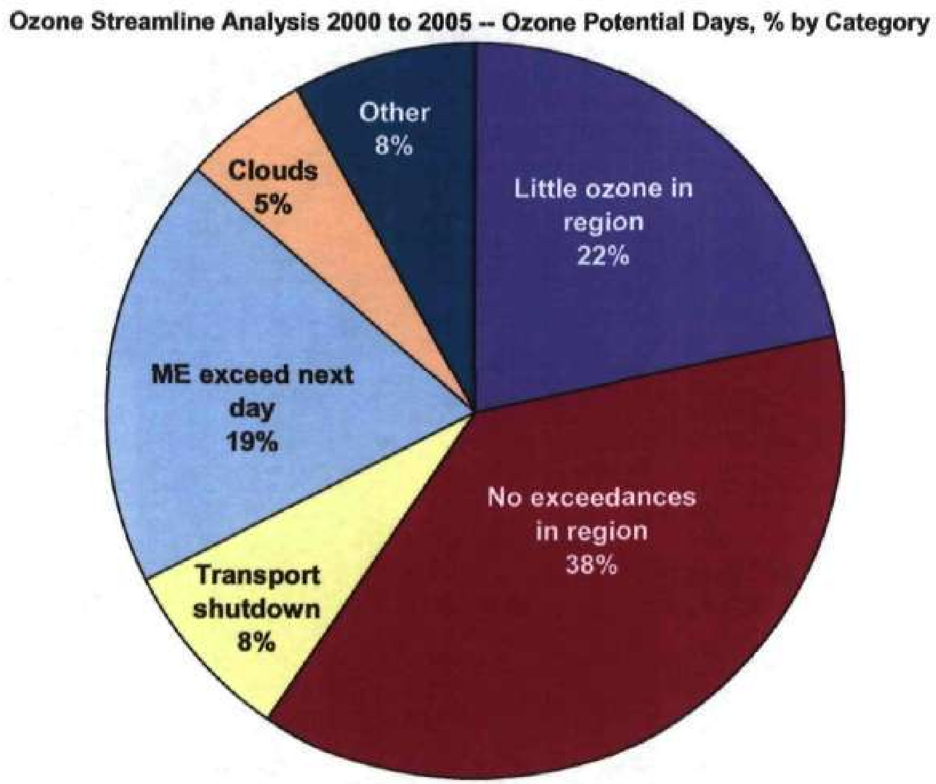
Approximately 73% of the streamline graphics clearly demonstrated that, while temperatures were high (as defined above) in the region and/or ozone exceedances occurred in Southern New England, the winds were not conducive to transport ozone and/or its precursors to Maine. On 37 days (the remaining 27%), the graphics displayed southwest winds over at least some part of Maine as well as meeting at least one of the criteria above. These days warranted further analysis and are referred to as 'ozone potential days'. Of these ozone potential days, there were few or no ozone exceedances recorded in the region approximately 60% of the time, so there was less ozone and its precursors available to be transported to Maine. Another 13% of the time, either clouds or wind shifts prevented ozone exceedances in Maine. Conditions may have contributed to ozone exceedances in Maine the next day 19% of the time Ozone potential days were categorized in the following manner:

- No exceedances in the region,
- Little ozone in the region – only a few sites recorded exceedances (often in Connecticut),
- Transport shutdown – incoming front shifted winds before transport could cause exceedances in Maine,

- Clouds – clouds moved into Maine during the afternoon effectively reducing ozone concentrations,
- ME exceed next day – conditions on these days were not conducive to same day ozone exceedances in Maine, however likely contributed to exceedances which occurred the following day, and
- Other – three days defied categorization, each was a special case in and of itself.

Ozone potential days' percentages are displayed by category in Figure C-4.

**Figure C-4 Ozone Potential**




In summary, the streamline analysis further demonstrates that high temperatures and bright sunshine are not the sole cause of ozone exceedances in Maine. Ozone and its precursors must be brought into the state, namely from the highly populated areas to the southwest of Maine.

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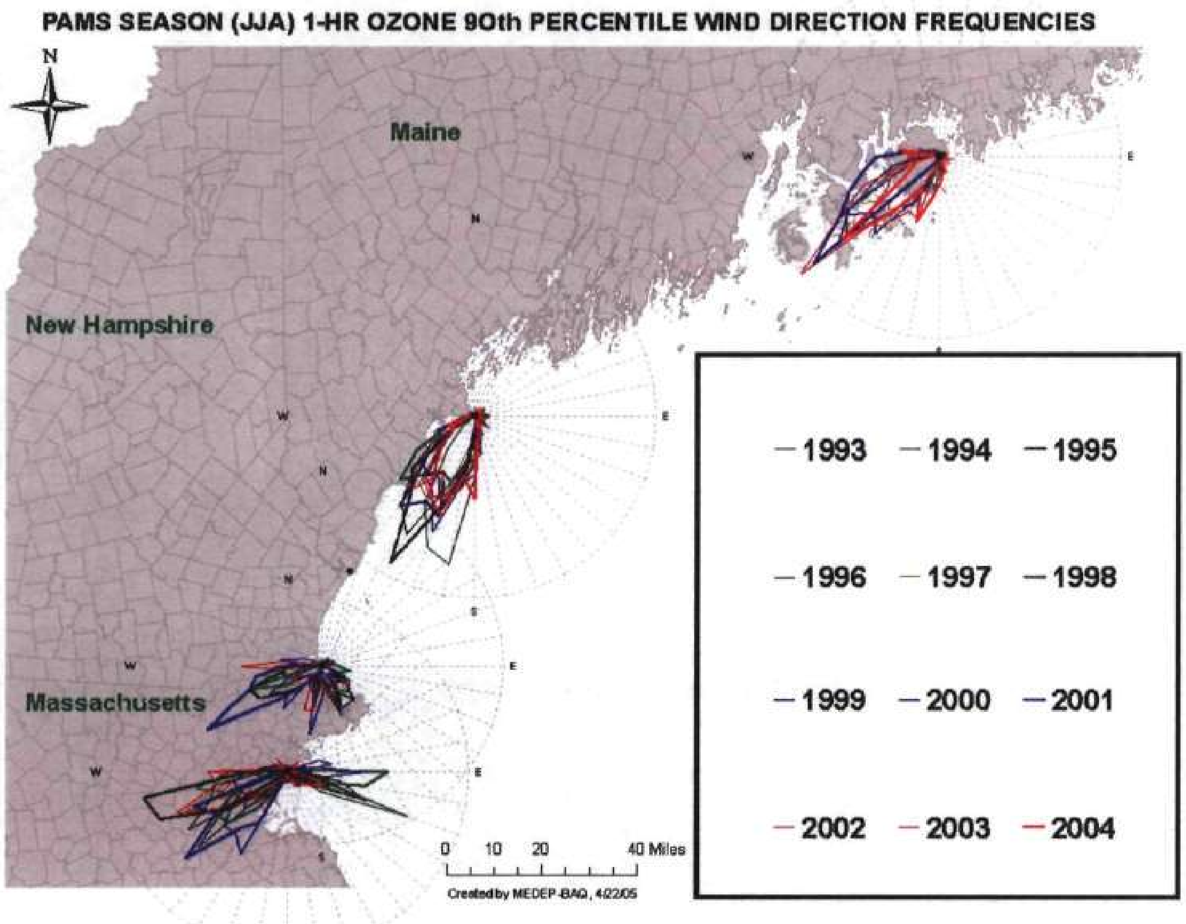
## PAMS – Meteorological Data

Photochemical assessment monitoring sites (PAMS) monitor chemicals associated with ozone formation, ozone and meteorological data.

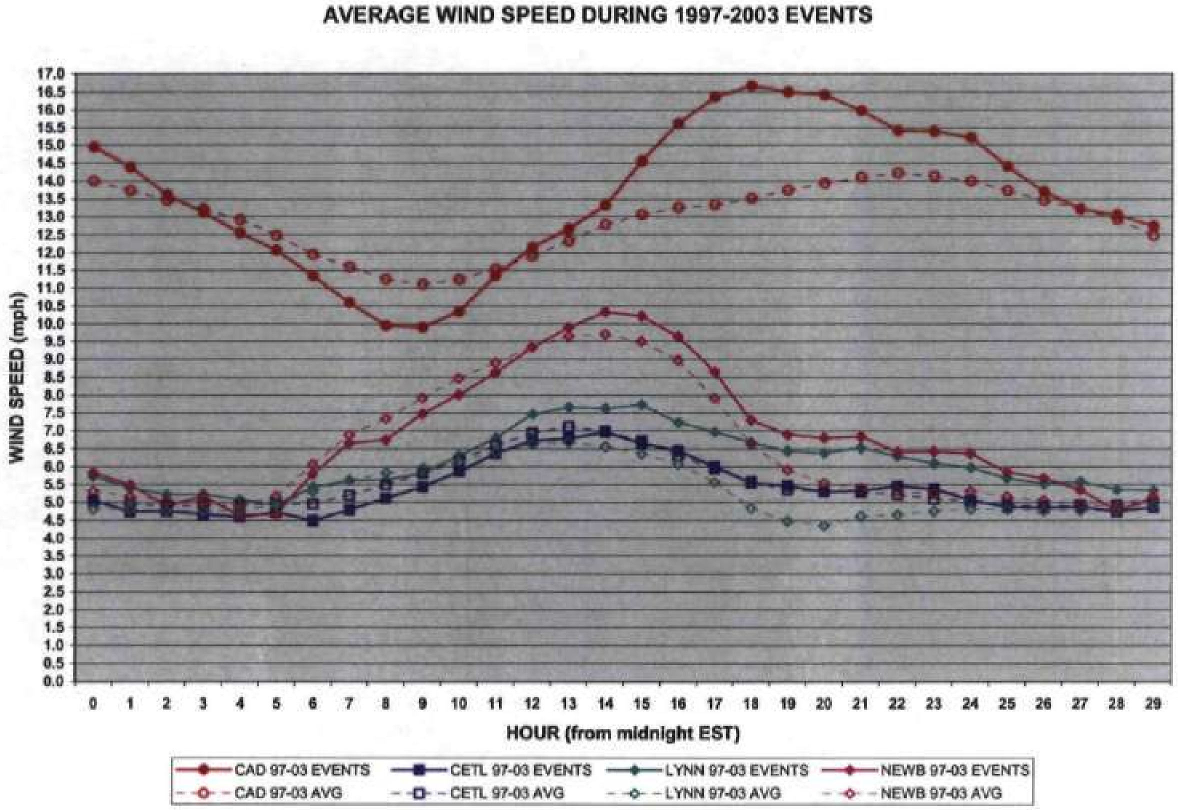
Wind frequency plots using the PAMS data build upon the trajectory and streamline analyses presented previously. In Figure C-5, the wind direction frequency at various ozone levels is plotted using Excel then superimposed over the site on a map for easy visual reference. Wind direction during high ozone events clearly demonstrates that it is southwest winds from urban areas outside of Maine that contribute to the exceedances.

**Figure C-5 Wind Frequency**




In Figure C-6, the wind speed during ozone event days is compared with the seasonal average wind speed. Both are graphed by hour of day. There is one site (Cape Elizabeth) in the graph from the Portland Nonattainment Area. While all sites show an increase in wind speed during the afternoon for all days, there is little difference between ozone events and the seasonal average. As with the previously presented analyses this graph clearly demonstrates that it is not stagnant conditions which cause ozone buildup in Maine, but rather wind is required to bring ozone and its precursors into the state.

# Figure C-6 Wind Speed



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## Anomaly Plots

Annual anomaly plots were created for June, July and August of 1988 through 2005 online at http://www.cdc.noaa.gov/cgi-bin/Composites/ (NOAA CIRES Climate Diagnostics Center in Boulder Colorado). These anomaly plots are presented following the discussion. Meteorological parameters affecting ozone concentrations were chosen for review as outlined below.

Surface variables affecting ozone concentrations

- Wind Speed and Pressure – surface transport indicator
- Temperature - More ozone production with higher temperatures
- Precipitation– lower levels allow more ozone production

Upper air variables affecting ozone concentrations

- 850mb (just above the surface layer) heights and Wind Speed and 250mb (jet stream height) Wind Speed – long range transport aloft and air mass movement indicators
- 850mb Temperature– Fewer clouds and more ozone production with higher temperatures

The 2005 Ozone Season was characterized by some parameters favoring ozone production and transport and some which did not, as listed below:

Conducive to ozone in Maine

- Surface and 850mb Temperatures – Above normal temperatures similar to Ozone Seasons with many exceedances
- 850mb heights, jet stream location– more sunshine, fewer showers and thunderstorms and slow moving air masses

Not conducive to ozone in Maine

- Surface Pressure and winds – Higher pressures over Maine and especially east and northeast of Maine resulting in more southerly component of the surface wind (tropical "clean" air mass)
- Transport aloft (850mb winds) -- lighter than normal resulting in less ozone and ozone precursors being transported to Maine

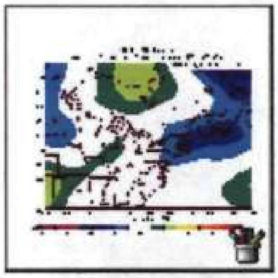
Table C-1 compares the various meteorological parameters with ozone exceedance days for each year for the months of June, July and August. The A's in the table identify those parameters which favored ozone for that year. Red indicates strongly favorable. The B's in the table identify those parameters which did NOT favor ozone for that year Blue indicates strongly unfavorable

Each year some parameters will favor ozone build up in Maine while others will not. The sole exception to that statement is 2004 which ranged from slightly unfavorable to strongly unfavorable and resulted in the fewest ozone exceedances on record for Maine.

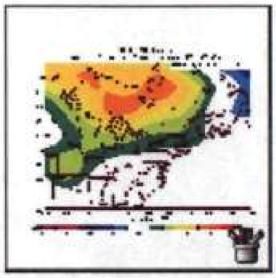
When comparing 2002 (14 exceedances) and 2005 (3 exceedances) the greatest differences between the two years relate to wind direction at the surface. It is important to note that in 1988, the year with the greatest number of exceedances, the wind direction was not as conducive to ozone transport as other high years (1991, 1993, 1995 and 2002) When ozone precursors are reduced, as mandated by emissions control programs at the state and federal levels, wind direction becomes a more critical factor for ozone buildup in Maine

As demonstrated in table C-1; many meteorological conditions favored ozone buildup in 2005. Thus, it was not unusual meteorological conditions that allowed the Portland Nonattainment Area to monitor attainment

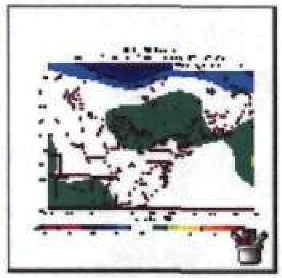
**Figure C-7 SURFACE PRESSURE ANOMALIES**



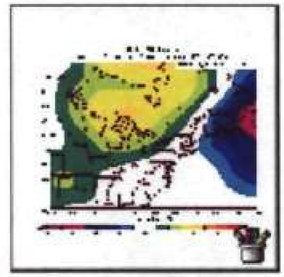
Surface Pressure anomalies JJA 1988



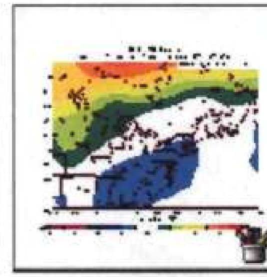
Surface Pressure anomalies JJA 1989



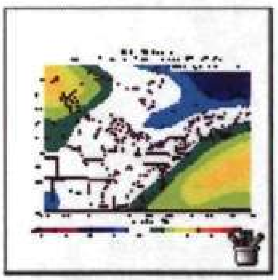
Surface Pressure anomalies JJA 1990



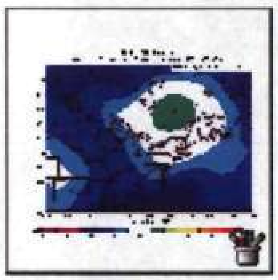
Surface Pressure anomalies JJA 1991



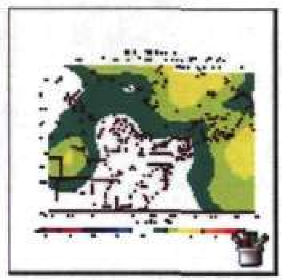
Surface Pressure anomalies JJA 1992



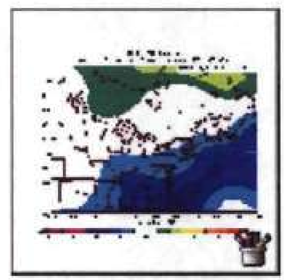
Surface Pressure anomalies JJA 1994



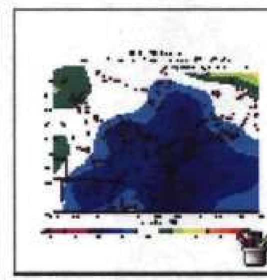
Surface Pressure anomalies JJA 1995



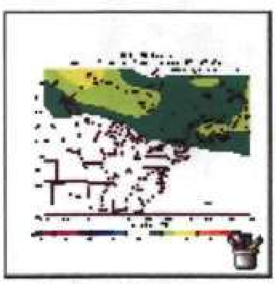
Surface Pressure anomalies JJA 1996



Surface Pressure anomalies JJA 1997

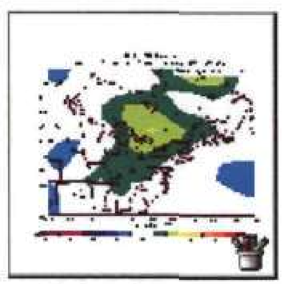


Surface Pressure anomalies JJA 1998

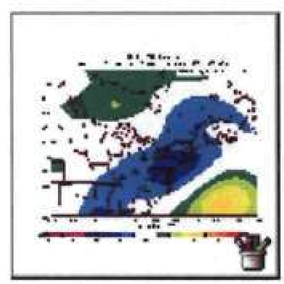


Surface Pressure anomalies JJA 2000

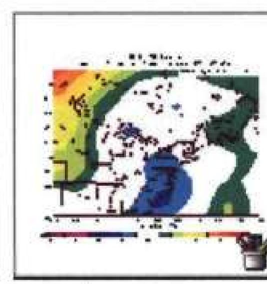
Surface Pressure anomalies JJA 2001



Surface Pressure anomalies JJA 2002



Surface Pressure anomalies JJA 2003



Surface Pressure anomalies JJA 2004

**Figure C-8 SURFACE TEMPERATURE ANOMALIES**

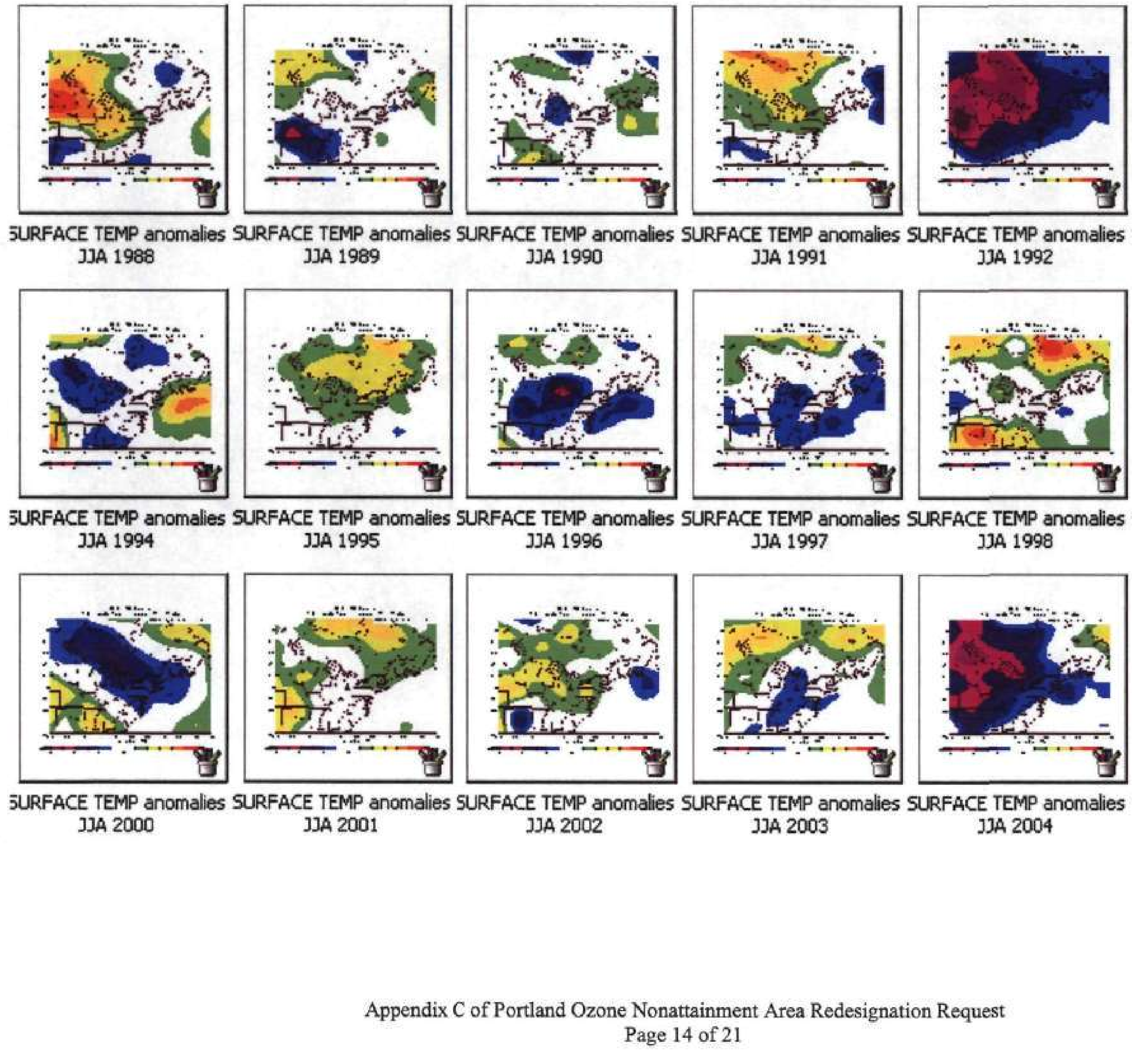


**Figure C-9 SURFACE WIND SPEED ANOMALIES**

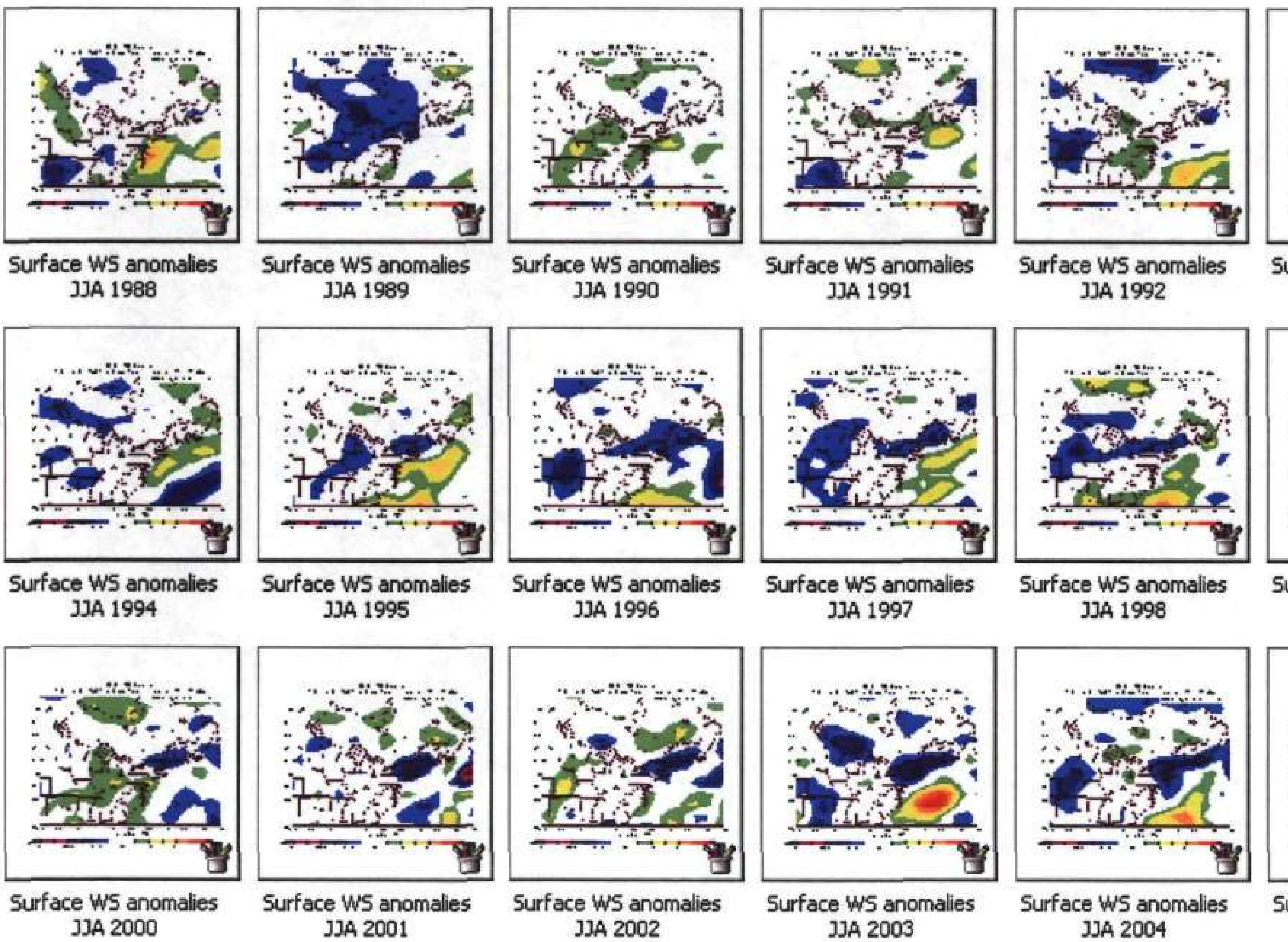


**Figure C-10 SURFACE PRECIPITATION ANOMALIES**

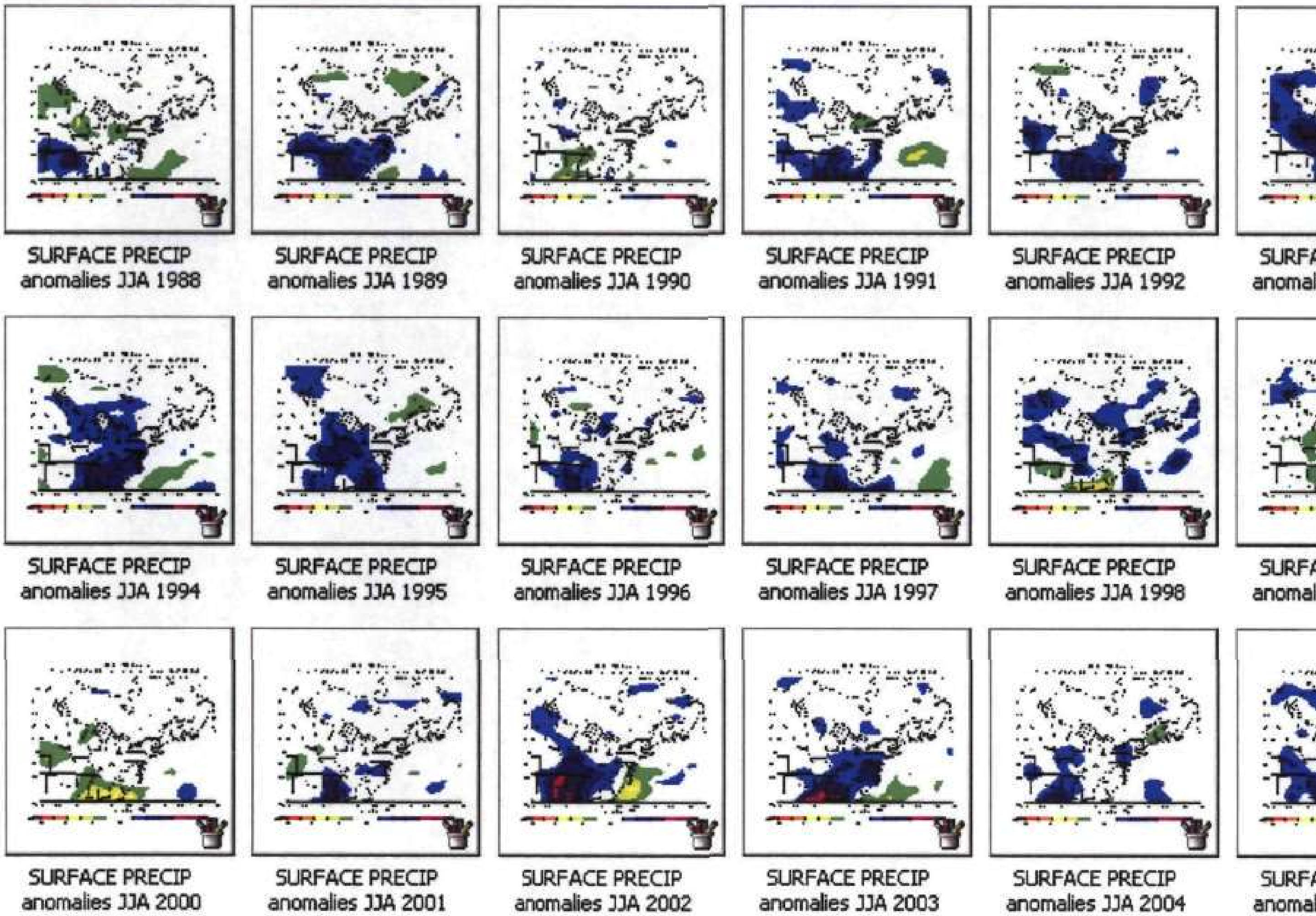
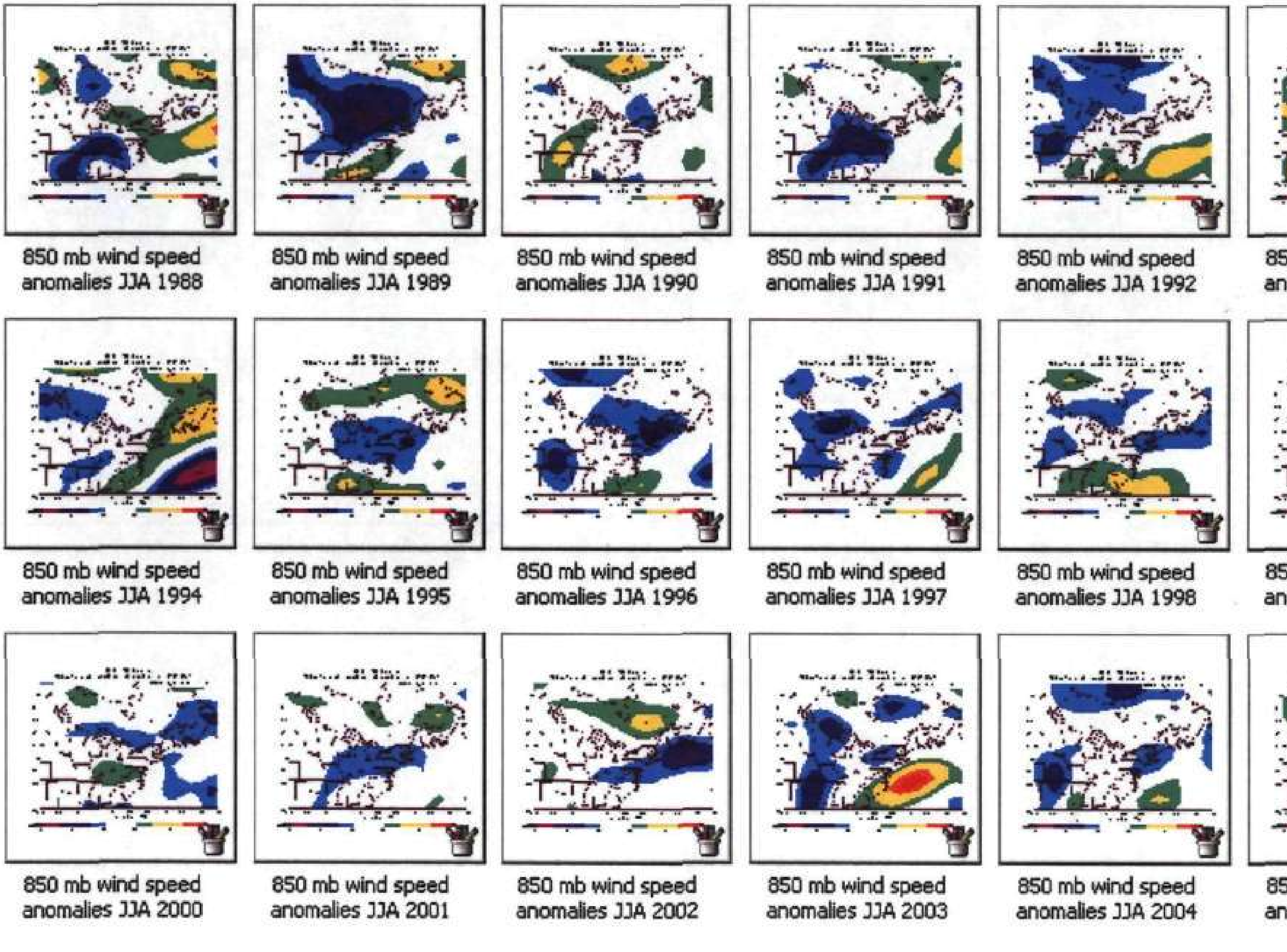


**Figure C-11 850mb WIND SPEED ANOMALIES**



850 mb wind speed anomalies JJA 1988

850 mb wind speed anomalies JJA 1989

850 mb wind speed anomalies JJA 1990

850 mb wind speed anomalies JJA 1991

850 mb wind speed anomalies JJA 1992

850 mb wind speed anomalies JJA 1994

850 mb wind speed anomalies JJA 1995

850 mb wind speed anomalies JJA 1996

850 mb wind speed anomalies JJA 1997

850 mb wind speed anomalies JJA 1998

850 mb wind speed anomalies JJA 2000

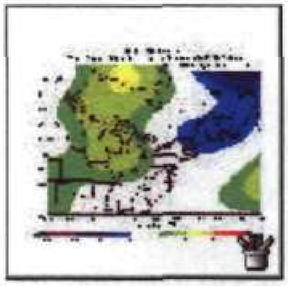
850 mb wind speed anomalies JJA 2001

850 mb wind speed anomalies JJA 2002

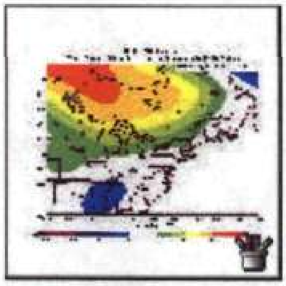
850 mb wind speed anomalies JJA 2003

850 mb wind speed anomalies JJA 2004

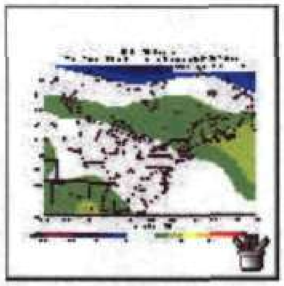
## Figure C-12 850mb HEIGHT ANOMALIES



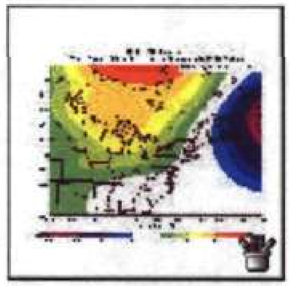
850 mb height anomalies
JJA 1988



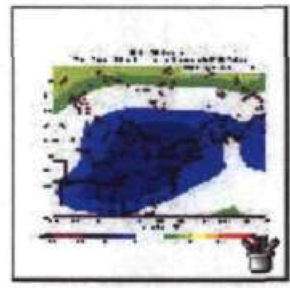
850 mb height anomalies
JJA 1989



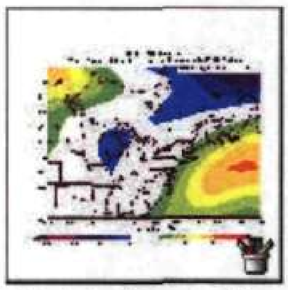
850 mb height anomalies
JJA 1990



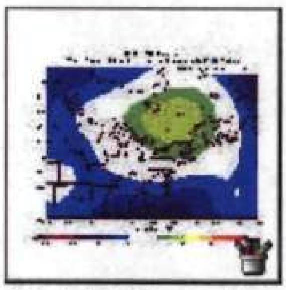
850 mb height anomalies
JJA 1991



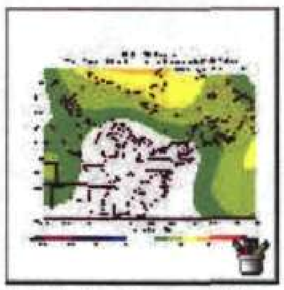
850 mb height anomalies
JJA 1992



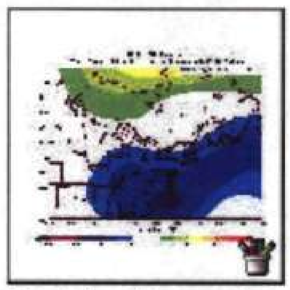
850 mb height anomalies
JJA 1994



850 mb height anomalies
JJA 1995

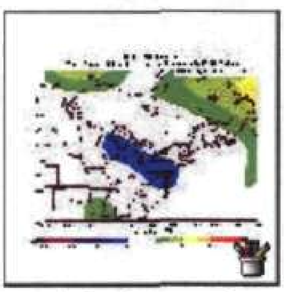


850 mb height anomalies
JJA 1996

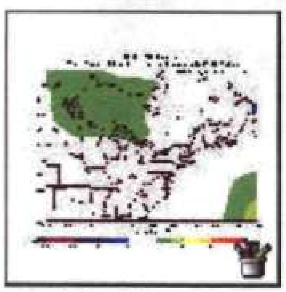


850 mb height anomalies
JJA 1997

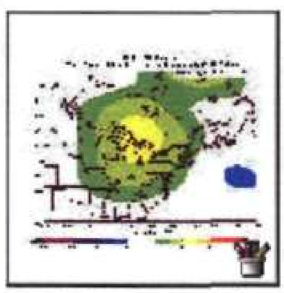
850 mb height anomalies
JJA 1998



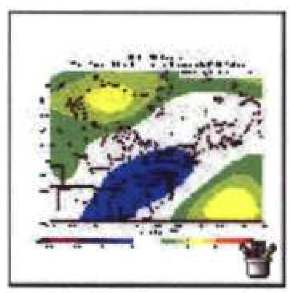
850 mb height anomalies
JJA 2000



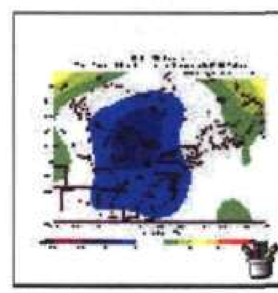
850 mb height anomalies
JJA 2001



850 mb height anomalies
JJA 2002

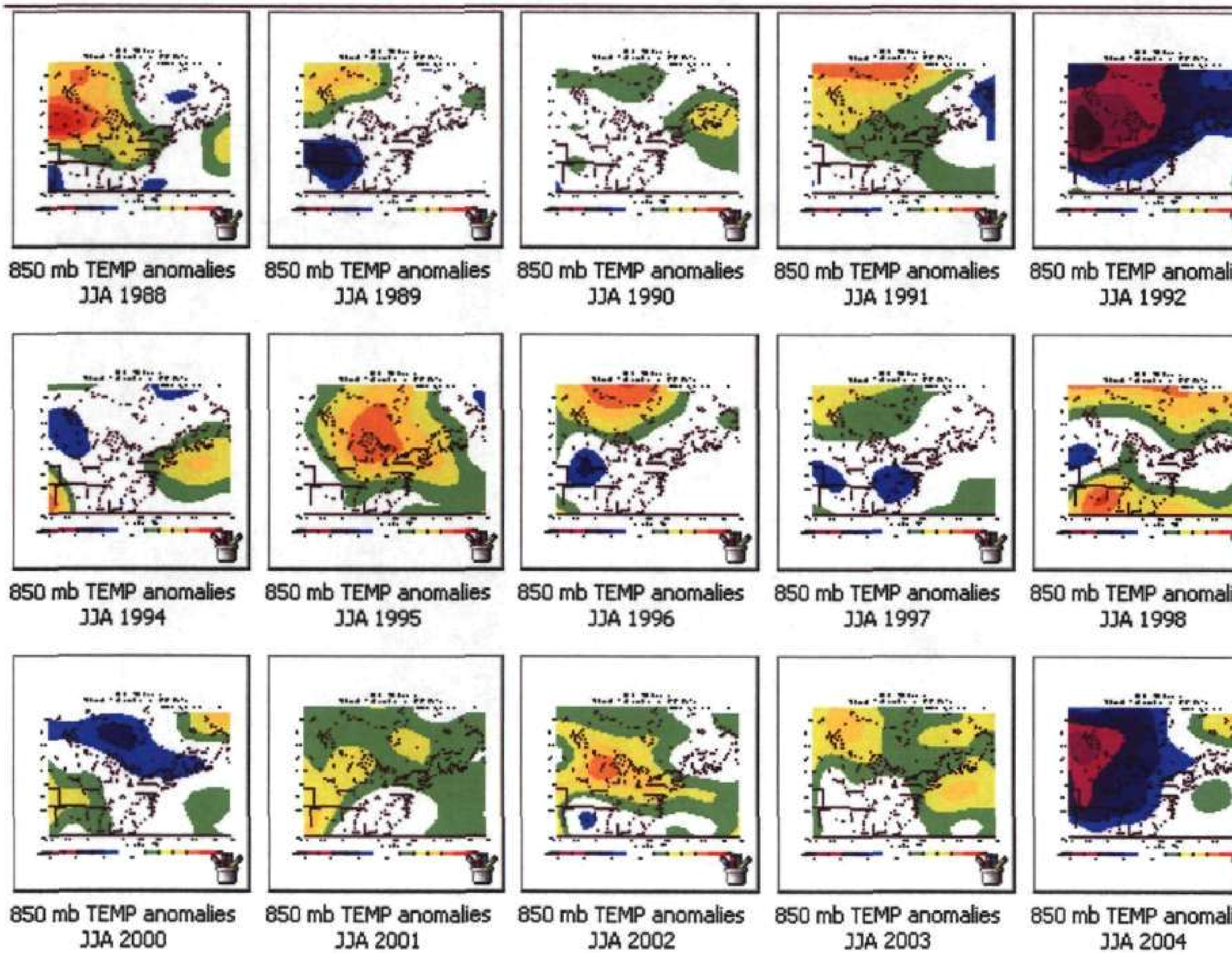


850 mb height anomalies
JJA 2003



850 mb height anomalies
JJA 2004

**Figure C-13 850mb TEMPERATURE ANOMALIES**



850 mb TEMP anomalies JJA 1988

850 mb TEMP anomalies JJA 1989

850 mb TEMP anomalies JJA 1990

850 mb TEMP anomalies JJA 1991

850 mb TEMP anomali JJA 1992

850 mb TEMP anomalies JJA 1994

850 mb TEMP anomalies JJA 1995

850 mb TEMP anomalies JJA 1996

850 mb TEMP anomalies JJA 1997

850 mb TEMP anomali JJA 1998

850 mb TEMP anomalies JJA 2000

850 mb TEMP anomalies JJA 2001

850 mb TEMP anomalies JJA 2002

850 mb TEMP anomalies JJA 2003

850 mb TEMP anomali JJA 2004

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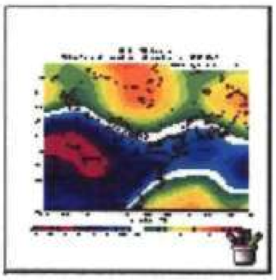
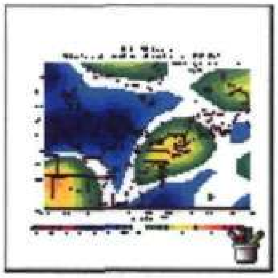
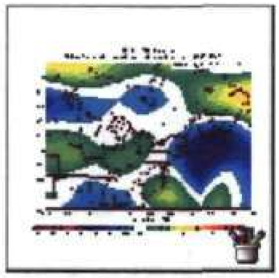
**Figure C-14 JET STREAM WIND SPEED ANOMALIES**



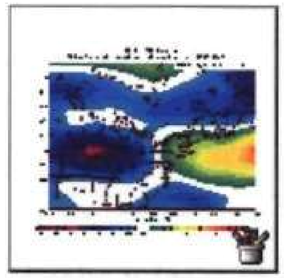
250 mb wind speed anomalies JJA 1988



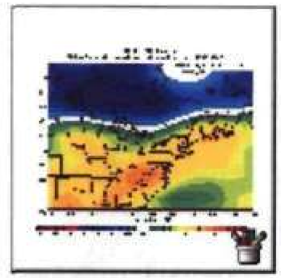
250 mb wind speed anomalies JJA 1989



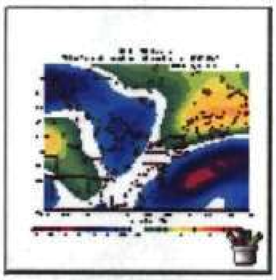
250 mb wind speed anomalies JJA 1990



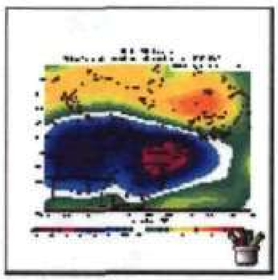
250 mb wind speed anomalies JJA 1991



250 mb wind speed anomalies JJA 1992

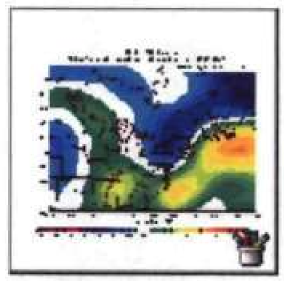


250 mb wind speed anomalies JJA 1994

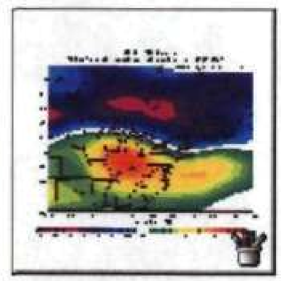


250 mb wind speed anomalies JJA 1995

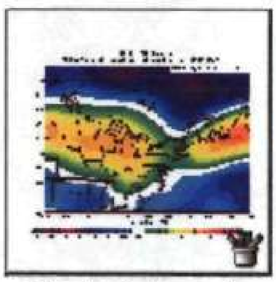
250 mb wind speed anomalies JJA 1996



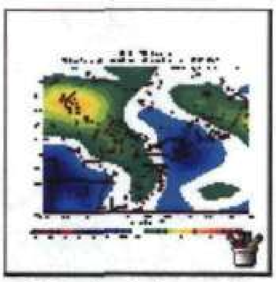
250 mb wind speed anomalies JJA 1997



250 mb wind speed anomalies JJA 1998

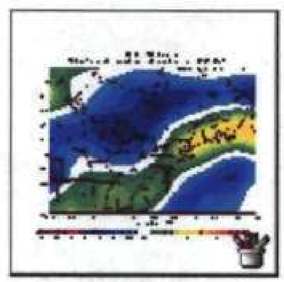


250 mb wind speed anomalies JJA 2000

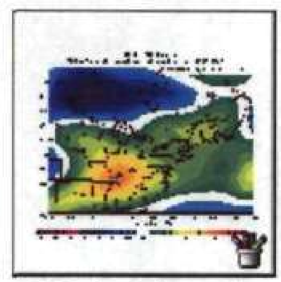


250 mb wind speed anomalies JJA 2001

250 mb wind speed anomalies JJA 2002



250 mb wind speed anomalies JJA 2003



250 mb wind speed anomalies JJA 2004

**Table C-1 Summary of Anomaly Plot Data with Ozone exceedance data**

| number of monitors | 6 | 6 | 10 | 10 | 10 | 11 | 14 | 14 | 13 | 15 | 16 | 16 | 16 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| EXCEEDANCE DAYS | 29 | 8 | 12 | 15 | 9 | 13 | 9 | 13 | | 11 | 7 | 8 | | 10 |
| EXCEEDANCE MONITORS | 131 | 30 | 39 | 70 | 35 | 41 | 30 | 48 | 15 | 41 | 26 | 22 | 4 | 43 |
| EXCEEDANCES PER MONITOR | 21.8 | 5.0 | 3.9 | 7.0 | 3.5 | 3.7 | 2.1 | 3.4 | | 2.7 | 1.6 | 1.4 | | 2.9 |
| EXCEEDANCE HOURS | 1092 | 227 | 272 | 508 | 217 | 189 | 143 | 281 | 96 | 259 | 208 | 148 | 18 | 297 |
| EXCEEDANCE HOURS PER MONITOR | 182.0 | 37.8 | 27.2 | 50.8 | 21.7 | 17.2 | 10.2 | 20.1 | | 17.3 | 13.0 | 9.3 | | 19. |
| MODERATE AQI DAYS | 44 | 27 | 28 | 32 | 29 | 26 | 33 | 31 | 32 | | 35 | 32 | | 26 |
| MODERATE MONITORS | 261 | 90 | 120 | 184 | 143 | 134 | 159 | 193 | 140 | 151 | 149 | 158 | 76 | 156 |
| MODERATES PER MONITOR | 43.5 | 15.0 | 12.0 | 18.4 | 14.3 | 12.2 | 11.4 | 13.8 | 10.8 | 10.1 | | 9.9 | | 10.4 |
| MET (UNADJUSTED) | 6 | | 2 | 6 | -4 | 2 | 6 | 4 | | | | 8 | -4 | 6 |
| MET (ADJUSTED) | 14 | -6 | 2 | 16 | | 2 | 14 | 12 | | | | 14 | | 4 |
| SURFACE PARAMETERS | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 200 |
| PRESSURE (ANOMOLY) | | A | A | A | B | A | A | A | A | B | | A | A | A |
| PRESSURE (ORIENTATION) | A | B | B | A | A | B | A | B | B | A | B | A | | A |
| TEMPERATURE | A | B | B | A | | A | A | A | | | A | A | | A |
| WIND SPEED | A | | A | A | A | B | A | A | B | B | B | A | A | |
| SOIL MOISTURE | A | | A | A | | A | | B | B | A | B | A | A | A |
| 850mb HEIGHT | B | A | B | A | | A | A | A | A | | | A | B | A |
| 850mb TEMPERATURE | A | B | A | A | | A | A | A | B | B | A | A | B | A |
| 850mb WIND SPEED | A | B | B | B | A | B | A | B | | B | B | B | B | B |
| 250mb WIND SPEED | A | B | A | B | | B | B | A | B | B | | A | | A |
| 1000-500mb THICKNESS | A | B | A | A | | A | A | A | B | B | B | A | B | A |

| AREA TO LOOK Midwest and major cities in the east | A | B |
|---|---|---|
| PRESSURE (ANOMOLY) | above normal | below n |
| PRESSURE (ORIENTATION) | SW-NE orientation | NW-SE or |
| TEMPERATURE | above normal | below n |
| WIND SPEED | average or slightly above normal | below n |
| SOIL MOISTURE | average or below normal | above n |
| 850mb HEIGHT | higher than normal | below n |
| 850mb TEMPERATURE | higher than normal | below n |
| 850mb WIND SPEED | normal or higher than normal | below n |
| 250mb WIND SPEED | higher than normal north of USA | higher than normal over |
| 1000-500mb THICKNESS | higher than normal | below n |

# Appendix D

Methodology Used to Prepare
State of Maine
2006 Ozone Redesignation Inventories
Revision of April 13, 2006

In the first quarter of 2006, the Air Toxics and Emissions Inventory Program began the development of multi-year, ozone redesignation and maintenance plan inventories for nine Maine counties. The purpose of these inventories was to support the redesignation of two, 8-hour ozone nonattainment areas and four, 1-hour nonattainment areas to attainment status and provide a long-term demonstration that attainment could be maintained

In its letter to James Brooks on December 6, 2005, EPA outlined the requirements of this inventory:

- 2002 summer, daily emissions inventories for NOx and VOC which would serve as the base year for the four, 1-hour nonattainment area maintenance plans;
- 2005 summer, daily emissions inventories for NOx and VOC which would serve as the base year for the two, 8-hour nonattainment area maintenance plans;
- 2009 summer, daily emissions inventories for NOx and VOC which would serve as an interim year for all six maintenance plans;
- 2016 summer, daily emissions inventories for NOx and VOC which would serve as the end year for all six maintenance plans, and
- On-road mobile source emission projections, by town, for each 8-hour non attainment area. This projection will serve as the NOx and VOC emissions budgets for transportation conformity purposes

The purpose of this document is to provide a general overview of how each inventory was developed.

Point

Maine once again used the 2002 inventory from the recent SIP amendment, 15% VOC emission reduction plan (approved by EPA, FR14815, March 24, 2006) For later years, the Point Source Inventory data is grown out from 2004, using SIC growth factors from EGAS 5.0 Beta, for developing the 2006 Ozone Redesignation Inventories.

Wyman Station data for 2002 and 2004 is from EPA's Acid Rain Program

Nonpoint

Maine used its final submission to the 2002 National Emissions Inventory (February 2005, with state edits, May 1, 2005) as the basis for developing the 2006 Ozone Redesignation Inventory. Documentation detailing the development of 2002 NEI emissions estimates can be found in "Methodology Use to Prepare the State of Maine 2002 Emissions Inventory," (September 12, 2005) which is located on Maine DEP's website at http://www.state.me.us/dep/air/emissions/docs/ME_2002_NEI_Narrative_final.pdf.

The following additions and corrections were made to this data set.

- Petroleum and Petroleum Storage: Gasoline Service Stations Stage 1: Submerged (SCC: 2501060051) and Stage 1: Balanced Submerged (SCC: 2501060053) have been corrected for the ozone summer season. Annual emission estimate use average daily VMT to calculate emissions, however, summer daily VMT must to used to accurately calculate summer ozone season estimates. The ozone season estimates use summer-weighted VMT to allocate fuel distribution. All other parts of the calculation are consistent

- Petroleum and Petroleum Storage: Gasoline Service Stations: Stage 2: Total (SCC 2501060100) was deleted from the Nonpoint inventories. These emission estimates are now included with the Onroad sector. It was included in the nonpoint sector with the 2002 NEI because E.H Pechan, who had developed Maine's Onroad estimates, had specifically excluded Stage 2 emissions from the MOBILE model runs. For these inventories, however, we have left Stage 2 emissions with the Onroad estimates

- Petroleum and Petroleum Transport: Marine Vessels (SCCs: Crude Oil – 2505020030, Residual Oil – 2505020060; Distillate Oil – 2505020090; and Gasoline – 2505020120) emission estimates were changed after the 2002 NEI submission. In May 2005, Maine learned that all ballast is not segregated and zeroed out emissions from non-segregated ballasts

- Emission estimates for Commercial Bakeries (SCC: 2302050000) and Breweries (SCC: 2302070001) were added to the ozone redesignation inventories. These categories were include in Maine's recently approved 15% Plan inventory, but were not included in the 2002 NEI Emissions of wineries and distilleries were once again confirmed to be de minimus

- Two Nonroad sources have been grouped with the Nonpoint sector They include the following categories and SCCs:

| | |
|---|---|
| Marine Vessels; Port and Underway Emissions | SCCs: 228002100, 2280003100, 2280002200, and 2280003200 |
| Aircraft | SCCs 2275001000, 2275020000, 2275050000, and 2275060000 |

- Other Combustion: Prescribed Burning of Rangeland (SCC: 2810020000) was miscoded in Maine's 15% Plan as Other Combustion: Prescribed Burning for Forest Management (SCC: 2810015000). There is no prescribed burning for forest management in Maine's ozone nonattainment areas. Maine DEP then looked at the raw data and realized that the prescribed burning did not occur during the summer season. Therefore, Prescribed Burning of Rangeland was removed from these inventories.

- EPA-generated data for 11 Solvent Categories was added or substituted for Maine data This data was not available for Maine to use in its 2002 NEI submission. However, with some exceptions, we are using a majority of the data here since it is morecomplete The 11 Solvent Categories included VOC data for 43 SCCs. Where Maine had submitted state-calculated, VOC emission estimates for SCCs included in the 11 Solvent Categories, we deleted our state-calculated values in favor of the EPA estimates. The following is a list of exceptions to our acceptance of the EPA-generated data for the 11 Solvent Categories:

    1. Emissions estimates for Dry Cleaning – Coin-Operated Cleaners (SCC: 2420020370) were deleted because we have verified, through inspection and survey, that no such facilities exist in Maine

    2. Emissions estimate for Rubber/Plastics (SCC: 2430000000) was deleted because it was determined during our review of the 2002 Draft NEI that these emissions were included in the Point source inventory.

    3. Emissions from four SCCs in the Miscellaneous Non-Industrial. Consumer and Commercial Products categories (SCCs. 2460100000, 2460200000, 2460400000, and 2460800000) for which Maine has submitted data were reported under different SCCs (SCCs: 2465100000, 2465200000, 2465400000, and 2465800000) by EPA in the 11 Solvent Category data. The State data was deleted from the inventory to prevent double counting

Growth factors were developed using the EGAS model, version 5.0 beta Growth factor projections assumed a 2002 base year New SCCs created for the 11 Solvent Categories were not reflected in the EGAS model. Growth factors, based on similar SCCs, were used where the EGAS model provided none.

Annual emissions were apportioned to tons per summer weekday using EIIP, Volume III, "Introduction to Area Source Emission Inventory Development," Chapter 1, Section 4.2.6, "Seasonal Activity" and Section 4.2.8, "Calculations for Temporal Adjustments" (January 2001) See http://www.epa.gov/ttnchie1/eiip/techreport/volume03/iii01_apr2001.pdf. SCC-specific, apportionment factors can be found in the tblAnnual_to_TPSD table of the 2006RedesignationArea.mdb database.

Maine did take advantage of controls which were currently in effect or would become effective in future years. The following table lists the SCCs and control efficiencies expected in future years.

| SCC | Pollutant Code | 2002 Control Efficiency | 2005 Control Efficiency | 2009 Control Efficiency | 2016 Control Efficiency | Rule Citation 06-096 CMR |
|---|---|---|---|---|---|---|
| 2401001000 | VOC | 0 | 0 | 0 35 | 0 35 | CH 151 |

| SCC | Pollutant Code | 2002 Control Efficiency | 2005 Control Efficiency | 2009 Control Efficiency | 2018 Control Efficiency | Rule Citation 06-096 CMR |
|---|---|---|---|---|---|---|
| 2401005000 | VOC | 0 | 0 38 | 0 38 | 0 38 | CH 153 |
| 2401100000 | VOC | 0 | 0 | 0 35 | 0 35 | CH 151 |
| 2415030000 | VOC | 0 | 0 66 | 0 66 | 0 66 | CH 130 |
| 2415045000 | VOC | 0 | 0 66 | 0 66 | 0 66 | CH 130 |
| 2415065000 | VOC | 0 | 0 66 | 0 66 | 0 66 | CH 130 |
| 2415100000 | VOC | 0 | 0 66 | 0 66 | 0 66 | CH 130 |
| 2415100385 | VOC | 0 | 0 66 | 0 66 | 0 66 | CH 130 |
| 2415300000 | VOC | 0 | 0 66 | 0 66 | 0 66 | CH 130 |
| 2415300370 | VOC | 0 | 0 66 | 0 66 | 0 66 | CH 130 |
| 2415300385 | VOC | 0 | 0 66 | 0 66 | 0 66 | CH 130 |
| 2460100000 | VOC | 0 | 0 142 | 0 142 | 0 142 | CH 152 |
| 2460200000 | VOC | 0 | 0 142 | 0 142 | 0 142 | CH 152 |
| 2460400000 | VOC | 0 | 0 142 | 0 142 | 0 142 | CH 152 |
| 2460600000 | VOC | 0 | 0 142 | 0 142 | 0 142 | CH 152 |
| 2460800000 | VOC | 0 | 0 142 | 0 142 | 0 142 | CH 152 |
| 2461021000 | VOC | 0 8 | 0 8 | 0 8 | 0 8 | CH 131 |

Nonroad

Maine used the NONROAD2005 Emission Inventory Model (November 2005) for the nonroad engine emissions modeling. The following table summarizes the inputs

| South | [illegible] | [illegible] |
|---|---|---|
| Fuel RVP | 7 8 | 7 8 |
| Oxygen Weight % | 0.64 | 0 5 |
| Gas sulfur % | 0 0197 | 0 0339 |
| Diesel Sulfur % (default) | 0 25 | 0 2284 |
| CNG/LPG (default) | 0 003 | 0 003 |
| Min Temp | 63 | 63 |
| Max Temp | 90 | 90 |
| Avg Temp | 75 | 75 |
| Altitude | LOW | LOW |
| Stage II Control Factor | 0 0 | 0 0 |

All redesignation plan counties except Hancock and Waldo

| North | [illegible] | [illegible] |
|---|---|---|
| Fuel RVP | 9 | 9 |
| Oxygen Weight % | 0 64 | 0 5 |
| Gas sulfur % | 0 0197 | 0 0339 |
| Diesel Sulfur % (default) | 0 25 | 0 2284 |
| CNG/LPG (default) | 0 003 | 0 003 |
| Min Temp | 63 | 63 |
| Max Temp | 90 | 90 |
| Avg Temp | 75 | 75 |
| Altitude | LOW | LOW |
| Stage II Control Factor | 0 0 | 0 0 |

Hancock and Waldo Counties only

*Notes*
2002 RVP, Oxygen Weight % and Gas sulfur % calculated from 2002 Fuels report
0 25 Diesel Sulfur % for 2002 supplied by Pechan
NONROAD defaults used for 2005 and later years

Additionally, rail road fuel use data became available after the submission of the 2002 NEI, so the Locomotive emissions were recalculated using the following methodology:

1 Fuel usage totals were obtained from the major rail companies that did business in Maine in 2002, except for the Montreal, Maine & Atlantic Railway company. Montreal did not respond to our repeated requests for fuel use data

2 To estimate Montreal's fuel consumption, average fuel consumption per track mile value was calculated from the three large railways that had supplied data One company had supplied both the line fuel usage, and yard engine fuel usage. This percentage (15% in rail yards) was used to estimate the amount of fuel that Montreal burned in its yard engines, which was added to the value estimated for line work.

3. The number of switch yards and track miles per company and county were derived from GIS databases. Railroad tracks leased from the state were apportioned to each company, resulting in a 5% fuel usage increase per company. We assumed that each rail yard had one yard locomotive

4. To calculate emissions from Yard Locomotives, we multiplied the amount of fuel used in yard engines by the emission factors in Table 7 of the Sierra Document[1]. This was double checked against using the number of switch yards per company, (and the assumption of one yard locomotive per yard) and multiplying this by the emission factor in Table 8 of the Sierra Document. We also made an estimate of fuel use from switch yard engines by using the 226 gallons of fuel per day per engine consumption value in Sierra.

5. The amount of variability in emissions from these three methods, and the lack of cooperation by the rail road companies in volunteering fuel consumption data, points to the need to amend DEP's regulations to compel railroad companies to file emission statements

6. The Sierra Report shows large drop in the sulfur content in locomotive fuel in 2008, and variable emission factors over time. Additionally, we grew out railroad use from 2002 using EGAS growth factors

7. Once the per company emissions had been determined, these emissions were apportioned based on the the amount of track in each county, and the number of switch yards, as determined from the GIS database.

[1] Sierra Research, Inc "Revised Inventory Guidance for Locomotive Emissions, prepared for the Southeastern States Air Resource Managers, Inc (Sierra Research, Inc 1801 J Street, Sacramento, CA 95814), June 2004

## Onroad

Maine used MOBILE6.2 03 (September 24,2003) to generate emission factor for the redesignation inventories The following table summarizes the command inputs used in the input files.

| | |
|---|---|
| Evaluation Month | 7 (July) |
| Fuel Program | 1 (Conventional Gasoline East) |
| Fuel RVP | 7.8 for Kennebec, Androscoggin, Knox, Lincoln, Cumberland, Sagadahoc and York counties<br>9.0 for Waldo and Hancock counties |
| Min/Max Temp | 63. and 90. |
| Anti-Tampering Program | For Cumberland County (catalyst removal and gas cap)<br>`ANTI-TAMP PROG :`<br>`99 83 20 22222 11111111 1 11 096. 12111112`<br><br>For all other counties (catalyst removal only)<br>`ANTI-TAMP PROG :`<br>`99 83 20 22222 11111111 1 11 096. 12111111` |
| Stage II Refueling | Stage II refueling is only applicable to three counties Cumberland, Sagadahoc and York counties.<br><br>For Cumberland County<br>`STAGE II REFUELING :`<br>`95 3 45. 4.`<br><br>For Sagadahoc County<br>`STAGE II REFUELING :`<br>`95 3 41. 3.`<br><br>For York County<br>`STAGE II REFUELING :`<br>`95 3 35  3` |
| Inspection/Maintenance Programs | I/M Programs is only applicable to Cumberland County<br>`I/M PROGRAM : 1 1999 2025 1 TRC GC`<br>`I/M MODEL YEARS : 1 1974 2025`<br>`I/M VEHICLES : 1 22222 11111111 1`<br>`I/M COMPLIANCE : 1 96.0`<br>`I/M GRACE PERIOD : 1 1` |
| Maine LEV II Program | Data files specific for Maine's LEV II Program were developed and supplied by EPA.<br>`94+ LDG IMP : MELEV2.D`<br>`T2 EXH PHASE-IN : LEV2EXH D`<br>`T2 EVAP PHASE-IN LEV2EVAP.D`<br>`T2 CERT : LEV2CERT.D` |

Maine created two MOBILE6 input files for each county – one which used the National LEV Program input file and one which used the Maine LEV II Program input files (listed above). Maine is approved to take only 90% of the Maine LEV II credit and both files were needed to calculate those values. 90% of the Maine LEV II credit is taken for all years and all planning areas included in the demonstrations.

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# Appendix E
## Department Rules Incorporated in the State Implementation Plan
**As of 6/1/06**

| State citation | Title/subject | State effective date | EPA approval date | Explanations |
|---|---|---|---|---|
| Chapter 1 | Regulations for the Processing of Applications | 05/20/85 | 03/23/93, 58 FR 15430. | Portions of Chapter 1 |
| Chapter 100 | Definitions. | 07/25/95 | 10/15/96,61 FR 53639. | |
| Chapter 101 | Visible Emissions | 10/10/79 | 02/17/82, 47 FR 6829. | |
| Chapter 102 | Open Burning. | 01/31/72 | 05/31/72, 37 FR 10842 | |
| Chapter 103 | Fuel Burning Equipment Particular Emission Standard | 01/24/83 | 02/26/85, 50 FR 7770 | |
| Chapter 104 | Incinerator Particulate Emission Standard | 01/31/72 | 05/31/72, 37 FR 10842 | |
| Chapter 105 | General Process Source Particulate Emission Standard. | 01/31/72 | 05/31/72, 37 FR 10842. | |
| Chapter 106 | Low Sulfur Fuel Regulations. | 02/08/78 | 01/08/82, 47 FR 947. | |
| Chapter 107 | Sulfur Dioxide Emission Standards for Sulfate Pulp Mills | 01/31/72 | 05/31/72, 37 FR 10842. | |
| Chapter 109 | Emergency Episode Regulation. | 08/14/91 | 01/12/95, 60 FR 2887. | |
| Chapter 110 | Ambient Air Quality Standards | 07/24/96 | 03/22/04, 69 FR 13227 | Adopts PSD increments based on PM10, in place of increments based on TSP.<br><br>[See. Electronic Docket Number EPA-R01-OAR-2004-ME-0001 at www.regulations.gov EXIT disclaimer] |
| Chapter 111 | Petroleum Liquid | 09/27/89 | 02/03/92, | |

| | | | | |
|---|---|---|---|---|
| | Storage Vapor Control | | 57 FR 3948. | |
| Chapter 112 | Gasoline Bulk Terminals. | 07/19/95 | 10/15/96, 31 FR 53639 | |
| Chapter 113 | Growth Offset Regulation. | 06/22/94 | 02/14/96, 61 FR 5694 | Part of New Source Review Program |
| Chapter 114 | Classification of Air Quality Control Regions. | 04/27/94 | 08/30/95, 60 FR 45060 | Revision to Remove Presque Isle as nonattainment for $PM_{10}$ |
| Chapter 115 | Emission License Regulation | 06/22/94 | 02/14/96, 61 FR 5694. | Part of New Source Review Program |
| Chapter 116 | Prohibited Dispersion Techniques. | 10/25/89 | 03/23/93, 58 FR 15430. | |
| Chapter 117 | Source Surveillance | 08/09/88 | 03/21/89, 54 FR 11525. | |
| Chapter 118 | Gasoline Dispensing Facilities. | 07/19/95 | 10/15/96, 61 FR 53639. | Stage II vapor recovery requirements added. |
| Chapter 119 | Motor Vehicle Fuel Volatility Limit | 06/01/00 | 03/06/02, 67 FR 10100. | Controls fuel volatility in the state. 7.8 psi RVP fuel required in 7 southern counties. |
| Chapter 120 | Gasoline Tank Trucks | 06/22/94 | 06/29/95, 60 FR 33734 | |
| Chapter 123 | Paper Coater Regulation | 09/27/89 | 02/03/92, 57 FR 3949. | The operating permits for S.D. Warren of Westbrook, Eastern Fine Paper of Brewer, and Pioneer Plastics of Auburn incorporated by reference at 40 CFR § 52.1020 (c)(11), (c)(11), and (c)(18), respectively, are withdrawn |
| Chapter 126<br>Chapter 126 Appendix A | Capture Efficiency Test Procedures | 05/22/91 | 03/22/93, 58 FR 15282 | |
| Chapter 127 | New Motor Vehicle Emission Standards. | 12/31/00 | 04/28/05, 70 FR 21959 | Including Basis Statements and Appendix A. Low emission vehicle program, with no ZEV requirements Program achieves 90% of full LEV benefits<br><br>[See: Electronic Docket Number EPA-R01-OAR-2004-ME-0004 at www.regulations.gov [illegible]] |

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|---|---|---|---|---|
| Chapter 129<br>Chapter 129 Appendix A | Surface Coating Facilities | 01/06/93 | 06/17/94, 59 FR 31157. | |
| Chapter 130 | Solvent Cleaners | 06/17/04 | 05/26/05, 70 FR 30367. | [See: Electronic Docket Number EPA-R01-OAR-2004-ME-0005 at www.regulations.gov EXIT disclaimer] |
| Chapter 131 | Cutback and Emulsified Asphalt | 01/06/93 | 06/17/94, 59 FR 31157. | |
| Chapter 132 | Graphic Arts: Rotogravure and Flexography. | 01/06/93 | 06/17/94, 59 FR 31157 | |
| Chapter 133 | Gasoline Bulk Plants | 06/22/94 | 06/29/95, 60 FR 33734. | |
| Chapter 134 | Reasonably Available Control Technology for Facilities that Emit Volatile Organic Compounds. | 02/08/95 | 04/18/00, 65 FR 20753. | Regulations fully approved for the following counties. York, Sagadahoc, Cumberland, Androscoggin, Kennebec, Knox, Lincoln, Hancock, Waldo, Aroostock, Franklin, Oxford, and Piscataquis Regulation granted a limited approval for Washington, Somerset, and Penobscot Counties |
| Chapter 137 | Emission Statements | 11/10/93 | 01/10/95, 60 FR 2526 | |
| Chapter 138 | Reasonably Available Control Technology for Facilities that Emit Nitrogen Oxides | 08/03/94 | 09/09/02, 67 FR 57154 | Affects sources in York, Cumberland, Sagadahoc, Androscoggin, Kennebec, Lincoln, and Knox counties |
| Chapter 141<br>Chapter 141 Supplement - Federal Register 11/30/93 General Conformity Rule | Conformity of General Federal Actions | 09/11/96 | 09/23/97, 62 FR 49611 | |
| Chapter 145 | NOx Control Program | 06/21/01 | 03/10/05 70 FR 11879 | [See. Electronic Docket Number EPA-R01-OAR-2005-ME-0001 at www.regulations.gov EXIT disclaimer] |
| Chapter 148 | Emissions from Smaller-Scale Electric Generating Resources | 07/15/04 | 05/26/05 70 FR 30373 | [See: Electronic Docket Number EPA-R01-OAR-2005-ME-0002 at www.regulations.gov EXIT disclaimer] |

| | | | | |
|---|---|---|---|---|
| Chapter 151 | Architectural and Industrial Maintenance (AIM) Coatings | 10/06/05 | 03/17/06 71 FR 13767 | [See: Electronic Docket Number EPA-R01-OAR-2005-ME-0003 at www.regulations.gov EXIT disclaimer] |
| Chapter 152 | Control of Emissions of Volatile Organic Compounds from Consumer Products | 08/19/04 | 10/24/05 70 FR 61382 | [See: Electronic Docket Number EPA-R01-OAR-2005-ME-0004 at www.regulations.gov EXIT disclaimer] |
| Chapter 153 | Mobile Equipment | 02/05/04 | 05/26/05 70 FR 30367 | [See: Electronic Docket Number EPA-R01-OAR-2004-ME-0005 at www.regulations.gov EXIT disclaimer] |
| Chapter 155 | Portable Fuel Container Spillage Control | 07/14/04 | 02/07/05 70 FR 6352 | [See: Electronic Docket Number EPA-R01-OAR-2004-ME-0003 at www.regulations.gov EXIT disclaimer] |
| Vehicle I/M | Vehicle Inspection and Maintenance. | 07/09/98 | 01/10/01, 66 FR 1875. | "Maine Motor Vehicle Inspection Manual," revised in 1998, pages 1-12 through 1-14, and page 2-14, D 1 g Also, Authorizing legislation effective July 9, 1998 and entitled L.D. 2223, "An Act to Reduce Air Pollution from Motor Vehicles and to Meet Requirements of the Federal Clean Air Act " |